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For the American Repertory.

ON THE CONNECTION BETWEEN ELECTRICITY AND ANIMAL LIFE.

Agreeably to your request, I send you a brief and hasty sketch of my views of the connection of electricity and animal life, as explained in my lectures.

It is necessary to premise, that I think I have demonstrated that there are two electricities, and that their composition or union, particle to particle, constitutes caloric or heat. That the two electricities have different attractions for different ponderable substances, and are consequently differently combined, (but in definite proportions) in different ponderable bodies. That the vitreous electricity has an attraction for the supporters of combustion, as oxygen, chlorine, &c. and is consequently combined with them; that the resinous electricity is attracted by combustible substances, and is united with them.

These things being taken as established, I infer that in combustion there is a union of the electricities before combined with the combustible and supporter of combustion, forming heat. Thus, in the combustion of hydrogen, the vitreous electricity of the oxygen combines with the resinous electricity of the hydrogen, and forms heat. In the combustion of carbon, the same substance combines with the resinous electricity of the carbon.

Bearing these things in mind, we will now turn our attention to the animal system and economy. The first fact that strikes us is, that our food is composed chiefly of substances having an attraction for resinous electricity, while the air that supports respiration, oxygen, is combined with the vitreous electricity.

Dr. Bell supposed the great object of respiration to be, the oxygenation of the blood. He supposed the introduction of oxygen into the blood to be necessary to life, and the circulation of the blood through the lungs to be for the purpose of receiving it. But he has given us no reason why oxygen is necessary to life—or why, if necessary, it might not be supplied by nutrition in the proper amount. Neither has he given us any evidence that oxygen is received into the blood beyond the facts that the blood circulates through the lungs, and that the introduction of oxygen into the lungs, nearly in contact with the blood, is necessary to life.

Subsequent analyses of the breath seem to disprove the fact that oxygen is received into the blood, for it is found that about as much oxygen as is drawn into the lungs is exhaled from them, combined with hydrogen and carbon, in the form of vapor and carbonic acid. This has led some authors to suppose the great object of respiration to be the decarbonization of the blood; but why carbon is drawn into the blood through the thoracic duct, from nutrition, to be thrown out by respiration, is not explained, unless it is for the purpose of the production of animal heat, to which we must now turn our attention.

It is well known that the blood and animal body generally preserve a heat of about 98° through all seasons. Though the temperature of the surrounding atmosphere may be that at which mercury congeals, the blood preserves that of 98°. This heat is, on all sides, supposed to be derived from respiration. As the union of oxygen and carbon, in combustion, produces heat, their union in the lungs produces the same. Respiration is, in fact, supposed to be a slow combustion, in which the carbon and hydrogen in the blood unite with the oxygen in the lungs, and produce heat, as in ordinary combustion.

This theory, taken as a whole, is satisfactory. But there is one difficulty which has puzzled physiologists: If the heat of

animals is derived from a slow combustion in the lungs, we should expect to find it greatest at or near the lungs, as the heat of a fire is greatest near the fire; but we find it the same in every part of the system. Several attempts have been made to explain away this difficulty, but no one has yet succeeded in satisfactorily accounting for the uniform diffusion of animal heat.

I am now prepared to recur to the subject of electricity. According to the law of combustion stated at the commencement of this article, there should, in the union of hydrogen and carbon in the blood with the oxygen in the lungs, (or, in other words, in their combustion in the lungs) be a union of the resinous electricity combined with the former substances, with the vitreous combined with the latter, forming heat. Thus, the heat of the animal system must be derived from the union of these two electricities. This fact would not assist us in explaining the uniform diffusion of the heat through the system, if we should suppose their union to take place wholly at the lungs. But I suppose that they are by means, and for purposes, which both show the wisdom of our organization, prevented from uniting there.

The same substance, when differently combined with other substances, is also differently combined with the electricity it attracts. Oxygen and hydrogen, in the state of water, are combined with much less electricity than they are in the state of gas; and carbon is differently combined with resinous electricity as it is differently combined with other substances. Carbon and hydrogen, when passing the thoracic duct in chyle, are probably combined with resinous electricity enough to convert all the vitreous electricity of the oxygen with which they unite, into heat; but as soon as they enter the blood in the veins, they form new combinations, by which a great portion of their electricity is set free, and instantly diffused through the whole venous blood. The carbon and hydrogen are then carried through the heart to the lungs, where they unite with oxygen; but being divested of a part of their electricity, they have not enough to convert that of the oxygen into heat. The surplus vitreous electricity of the oxygen is therefore carried into the arterial

blood, through which it is freely conveyed to the extremities, where it unites in the capillaries with the resinous electricity of the venous blood.

The arterial blood, then, is always vitreously, and the venous blood resinously electrified; and the electricity is prevented from escaping by the comparative insulating power of the veins and arteries. This being allowed, it is easy to account for the contractions and expansions of the heart, and the consequent circulation of the blood, by the influence of electricity. The heart is composed of two auricles and two ventricles. The auricles form bag-like cavities over the orifice by which the blood enters the heart. When the heart is distended, they lie over this orifice, something like ears of a hound over the orifice in his head; but when the heart is contracted, they are distended with blood. In this state, the electricities of the blood have a free entrance into the heart; the resinous from the venous blood, and the vitreous from the arterial blood in the pulmonary veins. As the particles of each electricity possess a self repulsive power, the heart is distended by their repulsion until the upper surfaces of the auricles, which are non-conductors, press on the orifices into the heart, and cut off the electrical communications between it and the blood. When this is done, the two electricities unite by a slow conduction through the heart, and overcome their repulsive power by their mutual attraction, when the heart contracts, shutting the valves of the auricles, and forcing the venous blood from the right ventricle into the pulmonary artery, and the arterial blood from the left ventricle into the aorta. The auricles are now again distended with blood, the electrical communication is restored; the heart again expands; the blood is prevented by the semi-lunar valve from returning from the arteries to the heart, which is therefore again filled with blood from the veins, and the same motions are continually repeated.

We next turn our attention to the voluntary motions, which, I suppose, are produced much in the following manner: In the first place, a part of the resinous electricity of the venous blood is taken up by the nerves, and retained in them and in the brain until the will shall require its use. This allows a

preponderance of vitreous electricity in the system generally. This excess is received from the arterial blood by the muscles, and they are distended by its repulsive power; but when the will requires a contraction of the muscles producing motion, the resinous electricity is thrown into them from the nerves, when the electricities unite, and contract the muscles by their mutual attraction.

But here I shall perhaps be met by an objection: I shall be told that the particles of heat, whether composed of the two electricities or not, are self-repulsive, and consequently cannot contract the muscles by their attraction. To this I reply, that if the muscles possess any elasticity, we may account for their contraction, with only a diminution of repulsion; but the truth is, when the particles of heat are brought near each other in such a manner that the vitreous electricity of one is turned towards the resinous electricity of another, they attract each other; and there is probably in the muscular system a provision which compels them to unite in this manner.

The muscles, as your readers all know, are composed of fibres; and each of these fibres, which are separated from each other by sheaths that are non-conductors of electricity, is probably a tube, barely of sufficient size to admit the passage of two particles of electricity. If, now, we suppose these tubes to be partially filled with vitreous electricity, as in the following figure, and the resinous electricity to be introduced at the one end, the particles of the resinous would each join themselves to the first particle of the vitreous electricity, not already joined to the resinous, on the side nearest the end of the tube where they were introduced. The particles would then approach each other with the resinous pole of one particle towards the vitreous pole of another, and would be attracted like two magnets whose friendly poles were brought together. In the above figure, the particles of resinous electricity, which are marked with a cross, are supposed to enter the tubes at the left-hand end, and they all arrange themselves on the left-hand side of

the particle of the opposite electricity to which they are united. On the principle that the contraction of the muscles is produced by the conversion of electricity into heat, we readily account for the heat of the system produced by violent exercise, and for the increased respiration and food which such exercise demands to keep up the supply of electricity. But if the heat of the system is produced directly by respiration, why do we require increased respiration immediately after exercise, when the system is already oppressed with heat?

Respiration is, as we all know, carried on without the aid of the will, but is, nevertheless, partially under our control, as we can suspend our breath for a short time, or can enlarge or shorten our respirations. This partial independence and partial subjection to the will, probably arise from the fact that the muscles of respiration draw their resinous electricity from the ganglionic system, or great sympathetic nerve, which is slightly connected to the brain by the pneumo-gastric nerve.

We next inquire, if electricity has any influence on the secretions of the glands, or on the absorption of the lymphatics? It has been supposed by various authors, that these are caused by electrical attraction; but it is difficult to conceive how this attraction can continue long unsatisfied, unless we can find some way in which electricity may be continually drawn from the glands. If a gland, either from being vitreously electrified, or from its natural attraction, attracts resinous electricity, it will draw to itself from the blood any substance that is resinously electrified; that substance may deposite its electricity, and pass into the secreting tube, making room for the approach of other matter similarly electrified; but the repulsion of the resinous electricity, thus accumulated, would in such case soon balance the attraction of the gland, and the action must cease. But if we suppose the electricity accumulated by the gland to be continually drawn from it by the nerves, the action may be continued until the nerves and brain are saturated; and if the electricity is thrown by the will from the brain and nerves into the muscles, they may never be saturated, and the action of the gland may be perpetual. The secretions of the glands themselves may thus depend on exercise.

Experiments in galvanism prove that contractions of the muscles may be caused by electricity, and very probably there is in such experiments a union of the electricities in the muscle. May we not well suppose that the life-like motions produced in such cases are caused by a supply after death of the same moving principle which was supplied by the animal economy during life.*

In conclusion, we can now see why the animal system is furnished with two sources of supply, nutrition and respiration. The wants of animated nature require two substances, which, uniting at the command of the will, may produce the motions it requires; and in order that these substances may be kept separate until their union is required, it is necessary that they enter the system by different channels; and, accordingly, two sources of supply are given us. A. C. MOREY.

[For the American Repertory.]

New-York, Dec. 7th, 1841.

PROF. J. J. MAPES:

Dear Sir—In the November number of the American Repertory, under the "Proceedings of the Lyceum of Natural History," I observed a notice of a phenomenon connected with the freezing of water, which I communicated to the Lyceum of Natural History, stated in a manner which would lead to a misapprehension, I fear, on the part of the reader. The published account is as follows:

"Dr. Lee gave an account of a stream at Salisbury, Conn. which commences freezing at the bottom, and gradually freezes upward to the surface. This stream is about two miles long, and descends a mountain 1800 feet high, and is very rapid. He attributed the phenomenon to the rapid motion of the water, which allows portions of the water at the bottom to be reduced to a lower temperature than the surface, and to their being in contact with the ground, which is colder than the water."

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* When I commenced this article, I intended to have given some account of the theory of Galvini, and of the causes which led to its rejection by the philosophers of Europe; but as it would render this communication of too great length, I postpone its consideration for the present.

Now, my explanation of the phenomenon, which in shallow and very rapid streams is not an unusual one, was, that the whole mass of the water, as shown by the thermometer, being reduced several degrees below the freezing point, the water began to freeze at the bottom first, chiefly because its motion was there the least rapid—the same reason why water usually freezes first at the banks and near shores. Although slight motion is favorable to the freezing process, very rapid motion is unfavorable to it; accordingly, in the stream in question, it is not unusual to find its temperature in the coldest days of winter, and in its most rapid portions, reduced several degrees below the freezing point, without actual freezing; and the phenomenon above mentioned does not occur where the stream is most rapid, but at the foot of a declivity, on comparatively a level, or, at least, a gentle declination, but still with too rapid a current for ice to form upon the surface. It is also highly probable, indeed it may be considered as an established fact, that while the process of congelation is resisted by the violent agitation of the surface, it is promoted by the nature of the substances at the bottom. We know, for example, that water may be reduced to 26° Fah. without freezing; but that it immediately freezes on dropping into it a stick or a pebble, and the ice first forms upon the pebble itself. This experiment may be performed by any one on a very cold day, and it seems to me to illustrate the phenomenon in question. In the same way it can be shown, that while violent commotion prevents the process of freezing, gentle agitation promotes it.

It is not uncommon in New England for sawmills to be stopped by the formation of ground ice, which is sometimes found one or two feet thick. The same has occurred with mills on the Genesee river, in this state. In the Edinburgh Cyclopedia, (Art. *Ice*,) there are many facts of this kind recorded; also, in the 36th Vol. of the American Journal of the Arts and Sciences, as observed in James river, Va. and other places.

Very respectfully, yours,

CHARLES A. LEE.

401 Hudson Street.

For the American Repertory.

MATHEMATICAL PROBLEMS.

Mr. Editor—Permit me to propose the following questions to your mathematical correspondents:—

1. Let two men, A and B, be placed a given distance apart—A being due north of B. Let A start and run due east with a given velocity. Let B start in pursuit at the same time, with a given velocity greater than that of A. Required a rule to determine the time and distance run before B overtakes A.

2. Given the distance from any point to each of the angles of an equilateral triangle; required the sides of the triangle.

M.

NEW MODE OF PROTECTING CITIES FROM THE EFFECTS OF LIGHTNING.

M. Arago has proposed a plan for discharging clouds, in cases of storms, of the electric fluid which they contain, and thus preventing the frequent occurrence of hailstorms, which is generally produced by two currents of clouds, charged with positive and negative electricity, crossing each other. It consists in an improvement upon Franklin's experiment of the kite, with which he obtained an electric spark from a cloud, and afterwards Dr. Romas of Nerac, and Messrs. Linning & Charles of the United States, produced electric flashes three and four feet in length. M. Arago recommends that a small balloon, properly secured, armed with metallic points, and communicating with the ground by a rope covered with metallic wire like a harp-string, should be kept permanently floating in the air at a considerable height over the spot which it is wished to preserve from the effects of lightning or hail; and he expects that by such an apparatus as this a cloud might have its contents entirely drawn off without any damage being caused, or that, at least, the intensity of a hailstorm would be greatly diminished. The experiment is so simple that it is well worthy of a trial.—*Galignani.*

Making this notice—the only one, by the way, which a diligent search and inquiry have enabled us to meet with—of M. Arago's plan the text for our observations, we wish to place it upon record that Mr. J. A. Powers, who will be recognized at once by the reader as a correspondent of this journal, had so long ago as last July, (1841) at which time he communicated it to a gentleman connected with the Repertory, a plan matured for protecting cities from lightning, by balloons.

One modification of the plan proposed by him, consists in elevating, at the approach of the thunder-storm, a balloon of oiled silk—or some other like material impermeable to the gases commonly employed for inflating balloons—with the following appendages: The top of the balloon is armed with a hollow metallic cone of small diameter, the height of which should be equal to one-eighth the less diameter of the balloon. This cone should terminate in several finely pointed ramifications, and communicate at its lower extremity with two thin metallic bands passing vertically over the balloon, cutting each other at the top and bottom, and forming right angles. These bands are circular or elliptic (accordingly as the balloon is in the form of a sphere or spheroid) and communicate with the rope or cord at their lower extremity, by which the balloon is connected with the earth, thus forming a metallic communication between the cone and the rope. The rope should be covered with fine metallic wire, or be wetted previously to elevating the balloon, in order to render it more effectually a good conductor; and it should communicate with the earth by a metallic frame, consisting of a windlass, by which to elevate or depress the balloon at pleasure. The frame should have a metallic communication some 15 or 20 feet below the surface of the ground, that the electric fluid may be more readily dissipated.

Another modification of his plan consists in substituting a thin copper balloon, which it is proposed to have permanently elevated. This is armed at its upper extremity with a hollow metallic cone, the apex of which should terminate in several ramifications finely pointed with silver, and it is proposed to perforate the cone from the apex to the base, thereby to form an electrical communication between the outer and inner surface. The balloon is connected at its lower extremity with a rope covered with fine wire, which communicates with the earth.

Thus far we have given a brief outline of the plans proposed by Mr. Powers. He suggests that the electricity obtained from the clouds may generally be applied to practical purposes, particularly in facilitating the growth of plants and vegetables. In whatever light these plans are viewed, the projector is richly deserving of public approbation, not less from the ingenious

and interesting nature of his inventions than from the benevolent object he has in view, viz. *the protection of the lives and property of our citizens.*

For the further edification of our readers, we would remark that Mr. Powers has matured a plan expressly for protecting this city, by which, for an annual expense of three cents on each building, he proposes to protect the whole city and the shipping in the harbor. We are authorized to state that the plan, together with models, &c. illustrative of its practicability, will shortly be made public.

[For the American Repertory.]

METALLURGICAL NOTICES.

BY DR. LEWIS FEUCHTWANGER.

I. *On Solders, and Soldering of the Precious Metals.*

The art of joining two metals by means of an alloy softer than themselves is that of soldering, and is considered a very difficult operation in metallurgy. It is performed in two ways: first, before the charcoal fire and bellows; second, before the lamp and blowpipe. The wire to fasten the different parts, and the borax in a fluid and pulverized state, are the indispensable vehicles. After having been tied by means of wire to the exact position, the borax in its liquid state is touched over every part, and afterwards covered with pulverized borax from the solder box; the whole is put upon the fire for drying the borax, which is blowing and extending itself, and then it is recovered again, fit for the principal operation.

The solders used for the operation are of three different kinds: 1st, the hard; 2d, the middle; 3d, the soft solder.

It is necessary that the base of the gold or silver solder should be at least as fine as the substances for which it is intended to be used, in order to conform to color and hardness; and the solder has to be melted twice over before being put into bars, in order to have a perfectly uniform composition; and when ready, have to be forged cold. The gold solders may be dipped in cold water without interfering with their malleability; but

the silver solders must, on account of their containing brass and natural brittleness, be cooled slowly after having been annealed. The solder is now forged down, and then rolled between fine rollers to the desired size. The plates may now be cleaned in aquæ fortis, scraped on both sides, and, if necessary, a few drops of oil vitriol may be added to the aquæ fortis for removing any and all foreign substances from the surface.

The following table of the various compositions has been carefully prepared, and may be relied on as regards the proportions for the various purposes:

Gold Solder :—

Hard	Fine gold,	12
	Fine silver,	$2\frac{2}{3}$
	Pure copper,	$1\frac{1}{6}$
Middle	Fine gold,	12
	Fine silver,	4
	Pure copper,	2
Soft	Fine gold,	12
	Fine silver,	8
	Pure copper,	4

Silver Solder :—

Very Hard	Fine silver,	5
	Brass,	6
	Zinc,	2
Hard	Fine silver,	10
	Brass,	2
Middle	Fine silver,	6
	Brass,	2
Soft	Fine silver,	4
	Brass,	2

Dentists' Gold Solder :—

	Fine gold,	10
	Fine silver,	2
	Pure copper,	1

German Silver Solder :—

	German silver for casting composition,	2
	Zinc,	1

Copper Solder :—

Hard, malleable, and fusible.	Copper,	8
	Zinc,	1
Very Hard	Copper,	10
	Zinc,	1
Middle	Copper,	3
	Zinc,	1
Soft	Brass,	2
	Zinc,	1

Tin Solder :—

	Tin,	2
	Lead,	1

Large pieces, or such articles liable to be much worn or used among other operations, ought to be soldered only with the hardest solders, for the soft solders will not bear any other operation, such as coloring, &c.

Platina may be soldered, on account of its hardness, with any solder of the malleable metals, such as silver; but for chemical purposes, the finest gold, and without the addition of silver and copper, should be employed, so as to resist the action of acids.

[For the American Repertory.]

COPELAND'S MARINE STEAM-ENGINE.

The last number of the Repertory contains that which must have surprised many of its readers, viz. the specification of a patent granted to C. W. Copeland for an "improved marine steam-engine."

The inclined engine of the Missouri, the same as referred to in the specification, has been long and (by very many) favorably known as "Mr. Copeland's arrangement;" but that it contained any original features by which such arrangement might be secured by patents, has been by few even suspected.

It is not my intention to find fault with the arrangement of the "inclined engine," or in any way meddle with its merits, but only to inquire whether it is a subject of patent to the extent claimed, or not; whether or not the patent was granted for an invention "not before known or used by others."

From the very lengthy specification, we learn that the patentee claims "as new and as constituting his invention," three distinct features of the inclined engine:—

1. "The placing the cylinder in an oblique direction, with the lower end near to the bottom of the vessel, and allowing it to stand at such an angle as is required for the connecting of its piston-rod with the crank on the shaft of the paddle-wheel;" the object attained by which is "the ability to place an engine having any desired length of stroke, on board of a vessel, without regard to the depth of such vessel;" and also "greater simplicity and a more direct application of the power." With regard to the propriety of this part of the claim, the reader not familiar with other and similar instances, is referred to the steamer Despatch, built in New-York in 1836–7, expressly for "ocean service," in which was placed two inclined engines, (high pressure) with the lower end of each cylinder as near as practicable to the bottom of the vessel, and elevated to an angle suited to the proportion of the engines and the determined height of the paddle-wheel shafts; precisely the same in substance and *purpose* with the one to which the specification before us relates. The fact that these were not condensing engines does not meet

the objection to the claim, as the following instance will clearly show: Let us suppose that I have invented a new arrangement of a certain portion of a machine already universally known and used; now, to secure to myself any advantage from such invention, it will be necessary to secure by patent not only my invention, but also the only one of the known forms of such machine to which it is at all adapted. Would this be in accordance with the spirit or letter of the patent law? The low pressure engine of the Narraganset steamer, built in 1836, though not inclined to so great an angle, is precisely similar to the engines of the Missouri, so far as simplicity and direct action of the power are concerned.

2. "The manner of arranging and working the steam and exhaust valves; the same being effected by a direct action, that is, without the employment of the lifting rods and lifters usually required for that purpose." The manner of arranging the steam and exhaust valves is not set forth in the specification; but the manner of working them—by the direct action of the rock-shaft against the feet attached to the valve stems—is not new, having been in use as early as 1829, and from that to the present time, and in such public manner as to render it scarcely possible to escape the notice of an experienced engineer.

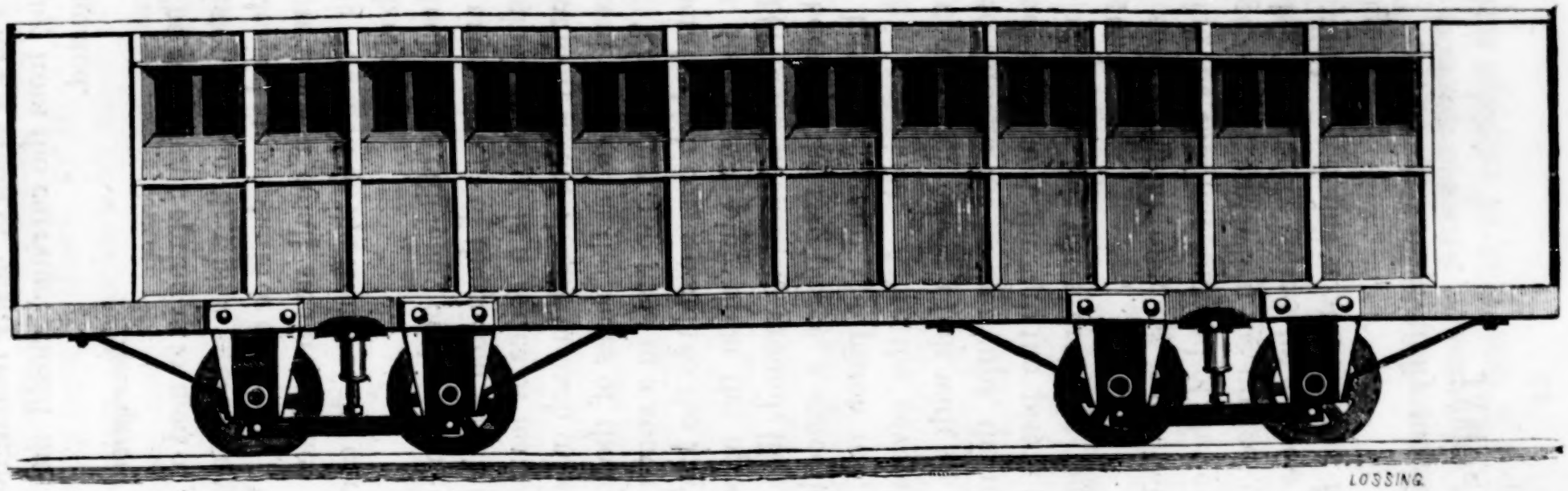
The remaining part of the claim refers to "the manner of combining and arranging the condensing apparatus;" a very clever arrangement, and very similar to that—if not precisely the same—as employed in one of the Brooklyn ferry boats, both the inventor and claimant of which are unknown to me.

As before stated, the purpose of these remarks has been only to inquire if, in the light of facts as here stated, the patent referred to can be sustained. The answer is due as well to the public at large as to that (at present) influential class of projectors, who, aside from the light of experience and common sense, are—in the utter darkness of doubt, and mistrust of everything known and practically approved—honestly searching for something *new*.

I shall be happy at any time to acknowledge an error in the position I have taken, or the statements by which it has been supported.

F. W. S.

AIR-SPRING FOR RAILWAY CARRIAGES, &c.



The Committee on Arts and Sciences beg leave to report in relation to the pneumatic spring of Alexander Connisen, referred to them for examination:—

That they deem it an invention of very great utility, and believe it will be found to possess the qualities of elasticity, durability, and exemption from accident, in a much greater degree than the ordinary metallic spring, now in use for carriages bearing heavy loads:

That it is peculiarly well adapted to railway trucks and carriages; as the Committee believe its application to these vehicles will be productive not only of increased safety and comfort to the traveler, but also of a great diminution in the wear of the carriages and road. And finally:

That its construction embraces a very efficient arrangement for retaining the air within the cylinder for a great length of time, and a mode of easily recharging it without removing the spring from the carriage, should the cylinder become partially exhausted.

Description.

The pneumatic spring is formed of a metallic cylinder having a piston within it, which presses against a column of highly condensed atmospheric or other air. When affixed to a carriage it resembles a small steam cylinder inverted; the piston rod being attached to the frame of the carriage, and the cylinder to the body.

Much of the efficiency of the spring depends upon the packing and arrangement of the piston which is thus constructed: The principal packing is a series of leather cups, say half a dozen in number, fitting closely in each other, the edges of which are pressed out against the sides of the cylinder by the column of air. The lowest cup rests in a concavity, in the face of a disk of metal which corresponds to the lower plate of a steam piston. This disk has a plug upon the opposite side, which fits into another plate accurately ground, like the first, to the cylinder; and between the two plates, a space is left for a hemp packing. The latter disk, and the piston rod, which is tubulated, are made in one piece. After the several parts of the piston are adjusted to each other, a bolt with an elliptical shaped head is passed through the leather cups, the metallic disk and plug, the second disk, and through the piston rod, and terminates in a nut, by which the parts are kept together, and the packings tightened.

A small tubular opening, provided with a valve, is made through the side into one end of the cylinder, for admitting the charge of air; and when the process of charging is ended, the opening is securely closed by a screw cap. The other head of the cylinder contains a stuffing box for the piston rod to pass through.

All which is respectfully submitted.

JAMES HOWLAND, *Sec'ry.*

MONTHLY RECORD.

Chemistry and Commerce.—Some very interesting results to the mercantile world have lately been obtained by Dr. Ure, from an investigation into the causes of a mildew by which several parcels of Corahs, received from Calcutta, were damaged. Subjecting these silks to a careful examination, to ascertain in what degree they possessed the property of absorbing moisture from the atmosphere, he found them imbued with a very deliquescent dressing or paste. Proceeding next to analyze the dressing of each piece of silk separately, he found it to be composed of a starchy matter, mixed with some substance which has a strong tendency to promote fermentative decomposition, as wood ashes, urine, common salt, or sugar, and sometimes with two or more of these substances. In many instances clay had been added to the mixture, probably, as Dr. Ure suggests, to give apparent substance to the thin silk web.

Notwithstanding great pains had been taken to make the tin plate and teak-wood cases containing the silks perfectly air-tight, several fissures existed in them, through which the air found access, and favored the formation of mildew, although the primary cause of the damage was beyond all doubt the bad quality of the dressing.

In concluding one of his reports, Dr. Ure remarks:—"Having demonstrated, by the clearest processes of chemical research, that the above mildewed Corahs had been damaged by the fermentative decomposition of the dressing paste with which they had been so abundantly impregnated, I would recommend the importers of such goods to cause the whole of the dressing to be washed out of them, and the pieces to be thoroughly dried before being packed up. I believe that clean silk may be kept and transported, even in the most humid atmosphere, without undergoing any change, if it be not imbued with fermentative paste."

New Spring for Carriages.—In the present number will be found a Report of the Committee on Arts and Sciences of the Mechanics' Institute, upon a new kind of carriage spring, in

which the elastic property of atmospheric air is employed to give an easy motion to the vehicle. We look upon this invention as one of extraordinary value, especially for railways, where its introduction will go far to prevent a most disagreeable annoyance—we mean the tremulous jarring of the car, which is a perfect barrier to reading or conversation. Railroad companies have their interests so bound up with the comfort of the traveling public, that it is almost unnecessary to press upon them the great advantage in point of economy of using air springs.

Switzerland.—A *bas-relief view*—so the maker calls it—of this picturesque country, showing the relative positions, heights and magnitudes of its towns, mountains and lakes, is now on exhibition at the American Institute.

Ure's Dictionary of Arts, &c.—We have received a copy of a prospectus for republishing this very valuable work, in 21 numbers, at 25 cents each. But as to where, or by whom, it is to be published, the prospectus is silent—and so are we, for we are not "wise above what is written."

NOTICES OF NEW PUBLICATIONS.

A Practical Description of Herron's Patent Trellis Railway Structure, embracing the most approved modifications; also, the Patent Wrought-Iron Railway Chairs, new and improved mode of joining the Ends of Railway Bars, Scarfing Timbers, and improved Fastenings: illustrated by four large Plates of Working Plans, accompanied by eighteen accurate estimates. Together with a compendious account of the process of Kyanizing, in use on the English Railways, for preserving the Timber from decay; and the recent discoveries of M. Boucherie by means of the Pyrolignite of Iron. Preceded by practical observations on the defective nature of the Railway Structures in use; with an investigation of the principles and structure essential to the stability and permanence of Railways, in which the opinions of men eminent in science and engineering are collated. By JAMES HERRON, *Civil Engineer.* Philadelphia: Carey & Hart and J. Dobson. 1841. For sale by Carvill & Co. New-York.

A very valuable work of 58 pages quarto. Mr. Herron's plan for constructing railways has received the approbation of a committee of the Franklin Institute, as well as of several eminent engineers.

Messrs. FRYE & SHAW, Nautical Instrument Makers, &c. have published their edition of the *Nautical Almanac and Astronomical Ephemeris for the year* 1844. The work is a reprint of the nautical part of the English Almanac, with some additions, and contains all that the navigator would require in such a publication. Fearful that the uninitiated reader may vainly speculate upon why an almanac should be published three years ahead—coupling it, perchance, with a malediction similar to that bestowed by Alan Fairford upon the Falkirk almanac—we would add, that it is desirable for mariners, before leaving port upon long voyages, to possess all the astronomical calculations they will need before their return.

PROGRESS OF SCIENCE.

Report of a Lecture delivered by Mr. Fownes before the Royal Institution, "On the Principles of Chemistry as applied to Agriculture." [From the Inventors' Advocate.]

The British Association, some few years back, requested Professor Liebig, of Giessen, to prepare a report on the state of organic chemistry —a part of which has already appeared on the continent, and has been translated into the English language by Dr. Lyon Playfair. This the lecturer duly acknowedged, and from the data furnished in the above work, nearly the whole of the facts were deduced. Soon after the publication of the translation of Liebig's work, we gave a full abstract of the leading points touched upon by the author in our columns: we shall now only give a brief report of the principal facts detailed by Mr. Fownes in his discourse.

The subject embraced the history of soils, germination of seeds, and other important details connected with the principles and practice of agriculture. The hardest substances in nature, in the course of time, become reduced to powder, or disintegrated, partly by chemical and partly by mechanical means. The great agents in producing these changes are, water impregnated with carbonic acid, the excreted matter from roots, and the action of roots themselves upon the soil.

The constituents which enter into the composition of arable land, are sand, clay and lime. When the former and the latter occur in a state of purity, the soil is barren, and necessarily so; the fertile soils owe their origin to the clay, or argillaceous earth. This clay is produced by the disintegration of minerals containing alumina, by the action of the weather principally. The most common minerals which hold alumina in their composition are the potash and soda felspars, labrador spar, mica, and the zeolites; and these are more or less met with in granite, gneiss, mica slate, porphyry, clay slate, grauwacke, and in the volcanic rocks, basalt, clinkstone, and lava. Of all the rocks, the mountain limestone contains the greatest quantity of argillaceous earths. The Jura limestone contains from 3 to 20 per cent, while that from the Wurtemburg Alps from 45 to 50 per cent. It was stated that these aluminous earths depend on their fertility on the presence of the alkalies, potash and soda, and on this principle it is that agriculturists have found it advantageous to add these substances to their lands. The sandy soil, or sand, can be produced in two ways—either by the disintegration of granite, &c. and carried down by streams to other situations, in which case the grains are more or less angular in their character, or it may be formed by mechanical attrition, as recognized on every sea-beach. But in whatever way soil is produced, it owes its character to the *humus*, which is the product of putrefaction of vegetable matter; this *humus* becomes converted into *humic acid*, and is soluble only in $\frac{1}{2500}$ part its weight of water.

It is the opinion of Liebig, that vegetables derive more nourishment from the air than they do from the earth, and this nourishment is offered

to them in the atmosphere in the form of carbonic acid, the result of various operations going on in nature, such as respiration, combustion, &c. Liebig asserts that although the absolute quantity of oxygen contained in the atmosphere appears very great when represented by numbers, yet it is not inexhaustible. One man consumes, according to this philosopher, 45 Hessian cubic feet of oxygen in 24 hours; ten centners of charcoal consume 58.112 cubic feet of oxygen during its combustion; and a small town like Giessen, (the residence of Liebig) with about 7000 inhabitants, extracts yearly from the air, by the wood employed as fuel, more than 1,000,000,000 of cubic feet of this gas. The air contains *in maximo*, 66 parts in 100.000 of carbonic acid gas, and 21.000 parts in 100.000 of oxygen gas. A man consumes in one year 166,075 cubic feet of oxygen gas (or 45,000 cubic inches in one day) according to Lavoisier, Seguin, and Davy; a thousand million men must accordingly consume 166,000,000,000 cubic feet in one year; this is equal to $\frac{1}{1000}$ of the quantity which is contained in the air in the form of carbonic acid. The carbonic acid in the air would thus be doubled in 1000 years, and man alone would exhaust all the oxygen, and convert it into carbonic acid in 303 times as many years. The consumption by animals, and by the process of combustion, is not introduced into the calculation.

Mr. Fownes briefly explained the production of this carbonic acid, and gave the received opinions as to the mode in which the vegetable kingdom received the greatest quantity of its food from it, viz. by the action going on in the leaves, &c. under the action of the sun's rays, the carbon of the carbonic acid is decomposed, and deposited, which augments the substance of the vegetable, while the oxygen is restored to the air in a pure state, fit for the respiration of animals.

The chemical examination of the atmosphere has only very recently shown that it contains *ammonia*, and this is deposited on the earth by the rain; and provided a pound of rain water, as has been shown, contains only one quarter of a grain of ammonia, then a field of 40,000 square feet must receive annually upwards of 80 lbs. of ammonia, or 65 lbs. of nitrogen. From experiments which Liebig has made, he has detected the presence of ammonia in rain water beyond all doubt. The water was collected some 600 paces S. W. of Giessen; when several hundred pounds of it were distilled in a copper still, and the first two or three pounds evaporated, with the addition of a little muriatic acid, a very distinct crystallization of sal-ammoniac was obtained; the crystals had always a brown or yellow color.

PROCEEDINGS OF THE INSTITUTION OF CIVIL ENGINEERS.

Upon the Application and Use of Auxiliary Steam Power for the purpose of shortening the time occupied by Sailing Ships upon distant voyages. By SAMUEL SEAWARD, M. Inst. C. E. [Reported for Newton's London Journal.]

But few years have elapsed since the possibility of propelling vessels by the power of steam was treated as a chimera; and although the practicability of its application for short voyages has been successfully

demonstrated, by the numerous vessels plying between this country and the continent, it is but of very recent date that its employment for long sea voyages has been adopted. The weight of the powerful machinery and the fuel, and the consequent loss of space for cargo, together with many other circumstances attendant on the present construction of steam vessels, induced the author (who received the education of a seaman, and has since had extensive practice as an engineer) to believe that a more efficient mode of employing steam power, for long sea voyages, might be adopted.

Notwithstanding the great improvements which have taken place in the construction of steam vessels, and their machinery, it would appear that the duration of the voyage ought not to exceed twenty days, after which time a fresh supply of fuel becomes necessary; hence, steam has rarely been adopted for very long voyages. The reason of this limit to the duration of the voyage of a steam vessel, as at present equipped, is that an increase of power does not produce a corresponding increase of speed, while the weight of machinery increases in proportion to the power employed, and in some cases exceeds it; for instance, small engines, with the water in the boilers, generally weigh about one ton per horse power, while in some large engines the ratio is nearly 25 cwt. per horse power.

A quadruple increase of power will not produce double the original velocity in a steamship, although in theory such is assumed to be the case; for, as the weight is more than double, the immersed sectional area becomes greater, and a still further increase of power is necessary. It has been shown by experience, that if a vessel, with a given power, is propelled through the water at the rate of eight miles per hour, her speed cannot be doubled, even though the power be multiplied twelve times, and the entire hold of the vessel be occupied as an engine room.

The weight of fuel is also in direct proportion to the size of the engines; so that taking for example, two vessels of 200 and of 400 horses power respectively—that of the higher power will have to carry nearly double the weight, both of fuel and of engines, and it is still questionable whether the increased force will propel the one ship more than $1\frac{1}{2}$ mile per hour faster than the other.

The space occupied by the engines and fuel, in the most valuable part of the ship, is also an important consideration; neither the British Queen nor President steamer, although of 2000 tons measurement, is capable of carrying more than 500 tons of cargo, when the fuel is on board.

The author then examines the question of employing too much power in a steam vessel, and refers to the Liverpool as an instance that such may be the fact. It appears that with the original dimensions of 30 feet 10 inches beam, and engine power of 450 horses, being a proportion of power to tonnage of about 1 to $2\frac{1}{4}$, the vessel was immersed four feet beyond the calculated water line, and a decided failure was the natural consequence; but when the breadth of beam was increased to 37 feet, augmenting the capacity of 400 tons, and giving the proportion of one horse power to $3\frac{3}{4}$ tons burthen, the performance of the engine and the speed of the vessel were both materially improved.

The Gem, Gravesend steamer, 145 feet long, by 19 feet beam, had

two engines of 50 horses power each; the speed was insufficient, being only 12½ miles through the water; but when the same engines were placed in the Ruby, which was 150 feet long, and 19 feet 9 inches beam, the velocity of the latter vessel was 13½ miles per hour. A pair of engines, of 45 horses power each, were then placed in the Gem, without altering the vessel, and in consequence of the diminished weight and draught of water, her speed then nearly equaled that of the Ruby.

The author does not condemn the application of considerable power for vessels, providing it can be employed without materially increasing the weight and the area of the immersed midship section. It appears that the length of a steam voyage, to be profitable, is at present limited to twenty days for the largest class of steamers; that we have about thirty others which can approach twelve days, while the majority cannot employ steam beyond eight days successively, without a fresh supply of fuel. It is evident, therefore, that more efficient means must be adopted for the general wants of commerce in our extended intercourse with the East and West Indies, the Pacific, Mexico, Brazil, Australia, and all the distant colonies, which now demand rapid communication with England.

The author refers to a pamphlet, published by him in 1827, entitled "Observations on the possibility of successfully employing steam power in navigating ships between this country and East Indies by the Cape of Good Hope." He therein proposed that large square-rigged ships, of 1500 to 1800 tons measurement, should be fully equipped and constructed, so as to sail 10 or 11 miles per hour with a fair wind; that they should carry engines of small power, to assist the sails in light winds—propel them at a moderate speed during calms—work into and out of harbor, &c.—and thus shorten those portions of the voyages wherein so much time was usually lost.

To all well-built, good-sailing vessels, of 400 tons and upwards, "auxiliary steam" is applicable. A steam-engine of the necessary power can, without inconvenience, be placed in such vessels, either on or between decks, so as to propel a ship at the rate of four to five nautical miles per hour in a calm, and for this speed a proportion of one horse power to 25 tons is amply sufficient. The practicability of applying this system to East Indiamen and other similar vessels, is then examined at length, and it is shown that the ordinary speed of these ships under sail is, before the wind, 11 to 12 miles per hour, and in a gale 13 to 14 miles per hour, which is greater by two or three miles per hour than that of any ordinary steam vessel when under sail, on account of the latter being impeded by the wheels trailing in the water, and the slightness of their masts, spars, and rigging. The auxiliary steam power might, therefore, be efficiently applied, either by using it alone, or in conjunction with the sails, so as to keep up a uniform speed, by which a great saving of time could be effected in a long voyage.

The conditions of sailing and steaming voyages to India, with the influence of the trade winds, are then examined, and the author proceeds to detail the experiments made by him, on board the Vernon Indiaman, which was the first sailing vessel that actually made a voyage out and home with "auxiliary steam."

The Vernon, built in 1839, by the owner, Mr. Green, was 1000 tons

burthen; the sailing speed was about 12 to 13 miles per hour in a fresh gale, and being from her frigate build well calculated for the experiment, it was determined to equip her with a condensing engine of 30 horses power, placed midships on the main deck, between the fore and main hatchways, the space occupied being 24 feet long by 10 wide. The weight of the machinery was 25 tons, and it was so arranged that the motion was communicated direct from the piston cross-head, by two side rods, to the crank on the paddle-shaft, placed immediately behind the lower end of the steam cylinder, which was horizontal. The wheels were 14 feet diameter, projecting five feet, and were so constructed that the float boards could be raised to suit the draught of water of the ship; or they could be taken entirely away, if necessary, leaving the shafts projecting only 18 inches beyond the sides. Under ordinary circumstances they were disconnected from the engine by a simple contrivance, consisting of a movable head, attached to the crank on the paddle-shaft, by turning which one quarter of a circle, the crank-pin was liberated, and the wheels turned freely round. The Vernon thus equipped, having on board 900 tons of cargo, and 60 tons of coal, drew 17 feet of water. In the first trial, the speed of the vessel, under steam alone, was $5\frac{3}{4}$ nautical miles per hour, demonstrating how small a power is necessary for a moderate speed. She then started for Calcutta; and though the piston rod broke three times during the voyage, owing to a defect in one of the paddle-shaft bearings, the passage was satisfactory. The details are given minutely, as are also those of the homeward voyage, which was performed from Calcutta to London in 88 days, to which must be added 7 days for necessary delay at the Cape, making a total of 95 days, which is the shortest passage on record. Great credit is given to Captain Denny for the judgment with which he used the auxiliary steam power, and the course taken by him, by which he was enabled to overcome the difficulties incidental to a first trial of so important a system. The success of the Vernon induced the immediate application of engine power to the Earl Hardwicke Indiaman, and both these vessels are now on their voyage out to Calcutta.

This communication was accompanied by drawings of the Vernon and the Earl Hardwicke, and by a chart, on which was laid down the proposed daily course of a steamship on a voyage to and from Calcutta, showing where sails only were necessary, then where steam alone, and also when the joint agency of steam and wind would be required; also the daily progress of the Marquis of Huntly Indiaman, of 1400 tons burthen, on a voyage to India and China, and home, from the author's own observation, in the year 1816.

For the purpose of demonstrating the ratio of power to velocity, a Table was also given, showing the velocities of ships of different tonnage, having steam power of various ratios, deduced from upwards of one hundred experiments on large steam vessels. The mode of disengaging the cranks was illustrated by models showing the gradation, from the complication of the first idea to the beautiful simplicity of the present plan, which is now employed on board of the Government war steamers.

Mr. S. Seaward explained the Table of velocities of steamships, which accompanied his paper.

The top line of figures represents the number of horses power, ranging from 30 to 300. The side line gives the tonnage of the steamships, rising progressively from 100 to 1200 tons. The intermediate spaces show the number of knots or nautical miles, which a ship of given tonnage, with a certain power, will travel through still water per hour.

The tonnage is calculated by the old rule (13 George III, cap. 74): "From the length subtract three-fifths of the breadth, multiply that sum by the extreme breadth in the widest part, and again by half the breadth, divide the product by 94, and the quotient will be the true tonnage."

The Table is constructed upon the principle, that each vessel of a good modern form will carry, at a proper draught, a weight equal to her measurement tonnage, and is presumed to be loaded equal to her tonnage, either by the weight of her engines, fuel, or cargo, and it terminates at 13 knots, at which speed the engines alone become the full load of the ship. The mode of constructing and of using the Table was fully described, and examples were given.

It was shown that an engine of 30 horses power would propel a ship of 1200 tons burthen at the rate of 4 knots per hour, while 300 horses power would only propel the same ship at the rate of $10\frac{5}{9}$ knots per hour. Hence, 10 times the power would only produce about $2\frac{1}{2}$ times the speed.

The principal points in the paper were more fully dwelt upon; and, in answer to questions from some of the members, Mr. Seaward remarked, that no steamer in England had ever been propelled at more than 15 geographical miles per hour through still water.

In some of the Government mail packets, the engines and coals were the full cargo of the vessel. The Table did not apply to vessels overladen with power; for as the weight increased in the ratio of the power, so the immersed sectional area was augmented, and the lines of the vessel, which might be well calculated for speed when at a proper draught, became lines of retardation, and the engines did not work up to their proper speed, owing to the depth to which the paddle-floats were immersed. For instance: The wheels of the British Queen have been plunged between six and seven feet, instead of four feet, which was the calculated dip; the engines at the same time diminishing their speed so much as to reduce the effective power from 500 horses to nearly 300 horses.

The only advantageous way in which great power could be applied would be by contriving to prevent the increase in the weight of the machinery and fuel; and those engineers would be most successful who could so apply the materials of construction as to insure strength without the usual corresponding increase of weight.

Mr. George Mills, from his experience as a ship-builder, at Glasgow, was enabled to confirm all that Mr. Seaward had advanced. On the Clyde, the employment of an excess of power in steam vessels had been carried to the greatest extent, without producing corresponding advantages, either for speed or in a commercial point of view. It would appear that the same error had, to a certain degree, been committed on the Thames, but less than on the Clyde; for on the latter river there were vessels with nearly double the power, in proportion to the size, as compared with any vessel on the former river. He believed that on

the Thames no vessels had so much as one horse power for each register ton; whereas on the Clyde, there were steamers of 70 to 80 tons register, having single engines, with cylinders of 54 inches diameter, which was more than 100 horses power. It would appear that this application of extra power had only obtained a very moderate speed, while the great first outlay, with the commensurate current expenses, had reduced the commercial profit to the lowest point—of this the proprietors alone could give any account; but as to the speed attained, he had seen three steamers of identical tonnage leave the Broomielaw at the same time, their engines being respectively of 110, 80, and 60 horses power; yet their speed was in the inverse ratio of their power: the vessel with the smallest engine arrived at Greenock first, the greater power second, and the greatest last. These remarks were only applicable to river boats. With regard to sea-going vessels, the system had not been carried to so serious an extent; yet with them the average proportion was about one horse power to two register tons, and some few reached as high as one horse to $1\frac{1}{8}$ of a ton.

As an example of an augmentation of power producing an opposite result from that which was intended, Mr. Mills mentioned two vessels, called the Tartar and the Rover, built by him and his (then) partner, Mr. Charles Wood. They were each of about 220 tons register, built from the same draught, and in every respect as similar as possible—except that the engines, which were by the same maker, were respectively of 170 and 130 horses power; yet whenever they worked together, the one with the smaller power proved herself the faster vessel, either in a calm, with the wind, or even against it. The Achilles, Liverpool steamer, which lately had an addition of 30 feet to her length, and 18 inches to her breadth, augmenting the tonnage about one-fifth, had improved her speed upwards of one mile per hour, although she carried a much heavier cargo than before.

He had built a vessel of 560 tons register, with engines of 130 horses power on board—a proportion of power to tonnage of one to four; the stowage for cargo was ample; the accommodation for passengers excellent. She drew little water, and her speed was much greater than vessels of double her power. Yet in spite of all this, the vessel could not find a purchaser, because the power was not nominally large.

It would be asked—why, with these and so many similar instances, such a system was continued? It was not likely that the engineers would complain of having orders for large engines; and there were certain dimensions prescribed for the vessel, to which the ship-builder was under the necessity of conforming.

The chief cause of mischief, however, was the fiat of the public. It was believed that a great power would remedy want of speed and all other evils, and it was found indispensable for insuring the confidence of travelers. Hence the ship-owners, who depend upon the public for support, were obliged, against the conviction of their experience, to keep up the errors occasioned by ignorance.

The President observed, that the condemnation of large power should not be carried too far, as experience alone had produced the increase of weight, strength and power of the present engines, compared with those of the early steamers which were built, instancing the Halifax

packets (Cunard's) which with their great power in proportion to tonnage, had performed their duties satisfactorily.

Mr. Mills explained that the Halifax packets were built for the especial purpose of carrying the mails only, to perform the voyage in a given time—about 12 days. The engines were built by Mr. Robert Napier, after the model of those of the Great Western, which used their steam expansively; similar provisions had been made in the Halifax packets, but the expansion valves were seldom used.

Mr. Field agreed with the principal part of Mr. Seaward's paper, but he would prevent an erroneous conception of the term *overpowering* a steamer. A vessel could not have too much power, provided that power could be advantageously applied, without causing too deep an immersion. A good result could be prodoced only by keeping a proper proportion between the machinery, the vessel, and the paddle-wheels, and immersing the hull of the steamer only as deep as the true lines of draught.

Mr. Vignoles observed, that in this country the reputation of engineers depended upon the commercial success of the works they engaged in. An erroneous public opinion might have influence present; but if the engineer and ship-builder would determine to break these trammels, and produce such vessels as should force conviction upon the public mind by the speed attained, and show the proprietors the consequent commercial advantage, the present system would soon be abandoned.

Mr. Parkes eulogized Mr. Seaward's candor in describing the errors in the first construction of the engine on board the Vernon; more was frequently to be learned from failures than from successful efforts, and no communications to the Institution would be so useful as those which gave accounts of defective design or construction, with the details of the methods adopted for remedying the defects. He directed attention to the performances of the Great Western steamship, which at least equaled those of the Halifax packets, without the disadvantages of being unable to carry cargo, or of shipping so much sea when the weather was foul. The important feature of economy of fuel on board the Great Western might be in part attributed to the use of steam expansively. It was very desirable that the Institution should possess very full drawings and a description of the Great Western, so as to be enabled to compare them with those of the Halifax packets, which had been promised by Mr. George Mills. He would impress upon manufacturers of marine engines the necessity of adopting a correct and uniform nomenclature of the power placed on board steam vessels. The nominal selling power did not accord with any calculation.

Mr. Field believed the Table of Velocities calculated by Mr. Seaward to be very nearly accurate. The speed of the Great Western, when loaded to her proper draught, had been as high as $13\frac{8}{10}$ miles through still water. There was an error in the alledged speed of Cunard's vessels; they reached Halifax in ten days, Boston in three more, and then had still one day's voyage to New-York. The average duration of the voyages of the Great Western was about $14\frac{1}{2}$ days. If 200 tons were deducted from the tonnage of the Great Western, for cargo and the accommodation for the passengers, she would then be similar to the Halifax packets. The engines of the Great Western were nominally

estimated at 400 horses power, and the average consumption of fuel was 26 tons every 24 hours.

During the discussion, Mr. Cubitt had calculated the following Table, showing the rates of velocity which would be attained by substituting engine power, with its consequent weight of one ton per horse power for cargo, so as to preserve the draught of water the same in all cases.

TABLE, *showing the power required to obtain various rates of speed in a steam vessel, where the total weight of cargo and engines remains in all cases the same, and in which, with a power of* 30 *horses, a speed of* 5 *miles per hour is obtained; and the total weight carried being in all cases* 1000 *tons, and the engines weighing* 1 *ton per horse power.*

Weight of Cargo.	Weight and Power in Tons and Horse Power.	Relative Speed.	Speed in Miles per hour.
970	30	$5\sqrt[3]{1}$	5.
940	60	$5\sqrt[3]{2}$	6.299
910	90	$5\sqrt[3]{3}$	7.211
880	120	$5\sqrt[3]{4}$	7.937
850	150	$5\sqrt[3]{5}$	8.549
820	180	$5\sqrt[3]{6}$	9.085
790	210	$5\sqrt[3]{7}$	9.564
760	240	$5\sqrt[3]{8}$	10.
730	270	$5\sqrt[3]{9}$	10.4
700	300	$5\sqrt[3]{10}$	10.772
670	330	$5\sqrt[3]{11}$	11.119
640	360	$5\sqrt[3]{12}$	11.487
610	390	$5\sqrt[3]{13}$	11.756
580	420	$5\sqrt[3]{14}$	12.050
550	450	$5\sqrt[3]{15}$	12.331
520	480	$5\sqrt[3]{16}$	12.599
490	510	$5\sqrt[3]{17}$	12.856
460	540	$5\sqrt[3]{18}$	13.103
430	570	$5\sqrt[3]{19}$	13.34
400	600	$5\sqrt[3]{20}$	13.572
370	630	$5\sqrt[3]{21}$	13.794
340	660	$5\sqrt[3]{22}$	14.01
310	690	$5\sqrt[3]{23}$	14.219
280	720	$5\sqrt[3]{24}$	14.422
250	750	$5\sqrt[3]{25}$	14.62
220	780	$5\sqrt[3]{26}$	14.812
190	810	$5\sqrt[3]{27}$	15.
160	840	$5\sqrt[3]{28}$	15.182
130	870	$5\sqrt[3]{29}$	15.3615
100	900	$5\sqrt[3]{30}$	15.535
70	930	$5\sqrt[3]{31}$	15.706
40	960	$5\sqrt[3]{32}$	15.854
10	990	$5\sqrt[3]{33}$	16.037

Mr. Seaward remarked, that his Table of power and velocities was corroborated by Mr. Cubitt's—the practical results verified both. The great difference between the Great Western and the Halifax packets, consisted in the better adaptation of weight and power to tonnage, and the more economical consumption of fuel of the former over the latter—the one carrying cargo and passengers, the other only the engines and fuel—yet the Great Western traveled farther with the same quantity of fuel.

In answer to a question relative to American steamboats, he believed that the build of the river steamers was very peculiar: some of them had engines of 600 horses power on board, yet they drew only 4 feet of water; whereas a sea-going steamer with that power would draw at least 16 feet. As far as he could ascertain, the actual well-authenticated speed did not exceed 14½ geographical miles per hour through still water. The fuel consumed could not be ascertained, as it was chiefly wood taken on board at the places of stoppage; there was a great consumption of steam at a very high pressure. Their machinery was not heavy, and was specially adapted to the vessels. Daily improvements were making in the form of vessels in England, and when high pressure steam and light engines were applied to vessels of a different form from those at present constructed, the speed must be increased. Some vessels were now building on the Thames of an extremely light construction, with tubular boilers, and the weight of the machinery would be only 11 cwt. per horse power.

Application of Hot-Blast in Smelting. [Being an extract from a correspondent of the London Mining Journal.]

Air increases in volume as its temperature is raised—its progressive rate of expansion is nearly uniform for equal increments of heat, and the law which governs this increase is, that gases expand $\frac{1}{480}$th of the bulk they had at the freezing point for every degree of Fahrenheit; it has also been ascertained that the constituents, as regards volume, are, that one cubic inch of oxygen, mixed with four cubic inches of nitrogen, will represent the proportions of any part of the surrounding atmosphere; by atomic weight, the relative proportions are nearly three and a half nitrogen to one of oxygen. Now, as combustion goes on accordingly as a greater or lesser quantity of oxygen is admitted into the furnace, it will follow that, where cold air is used, the *maximum* quantity of this elementary body is duly sent in, because the chemical proportions being known, the *quantum* of oxygen consumed can always be ascertained by calculating the dimensions of the cylinder and the number of strokes made per minute; but where hot-blast is employed, the temperature of the prepared air is liable to variation, and, as a matter of course, the important constituent of the atmosphere, above described, will vary with it. Thus, if the heat which the air receives from the stoves is only 480° Fahrenheit, it is clear that, at this temperature, it would exactly double its volume if unconfined; under such circumstances, a cubic foot would yield an amount of oxygen equal only to half

the quantity contained in a foot of cold air. The remedy for this is to confine or condense the hot air, and so admit it into the furnace, at what is termed a strong pillar of blast; and, in order to effect this, the motive power and blast apparatus must all be of sufficient capacity. If no other advantage arises from a proper application of the natural law herein described, than that of carefully suiting the machinery to the duty to be performed, it will be no inconsiderable benefit to those who embark in the manufacture of iron.

It is true that, whether with hot or with cold air, the oxygen forced in can always be calculated, because the delivery of blast from the cylinder must pass through the regulator into the heating stoves, and thence into the furnace, so that the absolute quantity can be easily ascertained; but as it is an object, in working with hot-blast, to arrive at a temperature much above 480°, say, 594°, the melting point of lead, which is, in fact, the test made use of it, it becomes necessary, in a high degree, to ascertain, by calculation, the equivalent pillar or extra pressure which will be required for every given increment of temperature —so that the dose of oxygen, which proper combustion demands, shall, by such increased pressure, be fairly supplied to the furnace. That this is of importance cannot be matter of doubt, when we know that, if the temperature of the hot air be 600°, (and it is often higher) it would, if not subjected to restraint, increase its bulk in the proportion as two and a quarter is to one. Fortunately, for easy calculation, the law holds good that the dilatation, previously referred to, is uniform, both at very high and very low temperatures, so that great exactitude may be arrived at. It may be objected to all these observations, that their application to smelting purposes can be of no use to the iron master; but I am satisfied that, if science goes hand in hand with manufacture, the latter must be benefited.

It has been found in the reduction of the Welsh ores with anthracite (to which this letter may be considered principally to refer,) that but little good can be done under a pillar of blast equal to $2\frac{3}{4}$lbs.; in fact, the greater the pressure and higher the temperature of the hot air, the more will this otherwise intractable fuel be made available to the reduction of the ores associated with it; indeed, by the aid of "hot-blast," stone-coal will smelt any description of iron mine whatever, it matters not how lean or how rich—whether a "mild" or a "hot" mine, as the local phrase goes—this remarkable fuel will reduce them all. And, by the singular certain manner in which it imparts its carbon during cementation, it enables those ores to be smelted with advantage which heretofore could not be used in the manufacture of good pig-iron; it will soon be seen that these very qualities, together with its capability of bearing transit, will occasion anthracite to be exported from Wales to foreign countries possessing iron ore but no fuel.

The general tendency of these observations is to the effect, that, in hot-blast, the higher the temperature the greater the necessity for a strong pillar to restore, in some measure, the attenuated state of the air, in order that the furnace may receive the proper quantity of the great supporter of combustion that may be due to its smelting powers; and, I think, I may safely say, that if the formation of furnace to suit the materials, (whatever be the description of the fuel,) and the adaptation

of blast to the same purpose, always received deliberate consideration previous to the erection of works, the melancholy disappointments and failures, which it is sometimes our misfortune to witness, would rarely occur.

The Submarine Telegraph. [Extracted from the Phare de Nyon.]

Prof. Colladon has just made an interesting experiment in our lake (of Geneva.) It has been long known that the effect of the collision of two hard bodies is sensible at a small distance under water. Franklin has recorded the fact, that if you plunge the head completely under water, you may hear the collision of two stones at the distance of half a mile. M. Burdenst, of the French Academy of Sciences, has made some experiments at rather greater distances at sea, using a bell *(timbre)* and plunging his head under water to listen. In 1826, M. Colladon undertook to measure accurately the velocity of sound under water in our lake. His experiments led him to discover that a thin metallic vessel closed below, open above, may emit a sound which travels under water without anything above indicating its existence. This discovery has led to that of an instrument by which the sound of a bell or other sonorous body, plunged and struck under water, may be heard at the distance of several leagues. Thus, instead of plunging his head, the observer may sit in a boat, his ear leaning on the instrument, which will receive below the surface of the lake the sonorous vibrations, that are propagated at the rate of a mile in a second. To take a measure, M. Colladon has some powder ignited at the moment that the bell is struck, while he watches for the signal at the distance of several leagues; as soon as he sees the flash, he sets the hand or index of the chronometer in motion, the sound arrives soon after; he stops the hand; the space which it has passed over on the dial marks the time that the sound has taken to traverse the distance. The measures taken by this means, at great distances, are remarkable for their precision and regularity. Water transmits sound four and a quarter times quicker than air; for in the atmosphere sound takes thirteen seconds to traverse a league, or three miles. M. Colladon made his experiments at first in the greatest breadth of the lake, between Rolle and Thonion: he has just repeated them at the enormous distance of nearly nine leagues, between the point of Promentheux and the hill of Grandvaux, near Cully. Thus, then, water is a body so perfectly elastic, that a blow with a hammer, struck by one man, moves the entire mass of our lake, that is to say, near 300,000 millions of lbs. of water, every drop of which moves in its turn, with a force capable of affecting a thin iron plate, to make M. Colladon's instrument sound. This is, doubtless, a marvellous fact, of which advantage may be taken in navigation; for at the distance of 10 leagues merchantmen are scarcely visible; the report of a cannon is heard or not, according to the state of the atmosphere: by the transmission of sounds under water, squadrons might be rallied, invisible signals given, by night as well as by day, in foggy as well as in clear weather. M. Colladon does not doubt that, under favourable circumstan-

ces, he could communicate at sea at the distance of 50 or 60 leagues. It is easy to distinguish under water the several kinds of sound proceeding from blows struck on iron, bronze, or wood. M. Colladon has found that it is an error to suppose that steamers frighten the fish by their noise. The paddles of a steam-boat of 100 horse power make scarcely any noise below water, much less than the beetle* of a washerwoman, or the collision of small pebbles.

Manufacture of Indigo in France from the Polygonum Tinctorium.
[Extracted from the Moniteur Industriel.]

This plant may ultimately be applied to most valuable purposes in our manufactures. Manufacturers are aware that during the time of the empire, in consequence of the continental blockade being unable to procure indigo from the East Indies, woad was substited for indigo, the cultivation of which was abandoned as soon as our ports were re-opened to colonial produce by the peace of 1814. The same circumstances may occur again, therefore too much attention cannot be bestowed on a new product, which is capable of rendering one of the most important branches of our trade independent of political contingencies.

The following particulars relating to the cultivation of this plant have been lately made public:—"When M. de Saint Hilaire imported the polygonum tinctorium from China, and mentioned the use to which it was applied by the natives of the country where it was found; when M. Villemorin had cultivated it in France, and had assured us that this plant could be brought to perfection in our country, Europe felt the importance of the discovery, and of the experiment to be made, and was at once aware of the immense advantages that would result if these expectations could be realized, and if this plant were able to supply the indigo that had hitherto been imported from Asia.

"The Society of Encouragement to National Industry, and the School of Pharmacy, successively appealed to modern chemistry, to induce a direction of its investigations to this discovery. The first experiments left no doubt as to the existence of the coloring matter of indigo in polygonum tinctorium, and the possibility of extracting it in quantities equal to those supplied by commerce is now incontestible. This is a fact M. Bussy has again proved in the report that he made on the 24th of last March, on the specimens sent to the Society of Encouragement for the prize that had been proposed.

Yes, it may be said, the polygonum can furnish indigo of the best quality; but is not this discovery destined to remain exclusively an addition to scientific knowledge, without being rendered applicable to industry or the arts? Will the expense arising from extracting indigo from the polygonum tinctorium admit of a comparison with the cost of that procured from abroad? It must, indeed, be admitted that the experiments hitherto made known, even according to the evidence of those who have conducted them, cannot be considered available for

* With which, in some countries, the washerwomen beat the linen they wash in the rivers, &c.

manufacturing industry. Consequently the Society of Encouragement has not awarded the prize proposed, and in prolonging the period granted for obtaining it till the 1st of January, 1843, new conditions are added, which prove how great is the desire of the society that this discovery should be converted to the purposes of national industry.

"This important difficulty is understood to be now overcome. M. Bebert, professor of chemistry and pharmacy at Chamberry, was the first to make public in Savoy two experiments for the extraction of indigo from the polygonum tinctorium. The indefatigable exertions of this celebrated chemist did not stop there, and two successive years of a continued series of experiments have been at length crowned with the most perfect success.

"This article, according to the new method he has adopted, is superior in beauty to those produced in every attempt that has been hitherto made. Messrs. Guibourg and Bussy have given him the most satisfactory testimonials of their approbation, and have not hesitated to compare the specimens he has sent to them with those of the finest quality from Bengal. The Society of Encouragement for national industry has also given public testimony that it takes the greatest interest in the results he has obtained by these specimens, and has expressed great regret that his discovery is not made public in France.

"M. Bebert must, therefore, be perfectly satisfied with the beauty of his productions, and the quantity that he has obtained offers the most flattering prospects to national industry, since we are assured in a manner not admitting of doubt, that by operating on polygonum of inferior beauty, and by not exhausting all its properties, a hectare of polygonum yields from 70 to 75 kilogrammes of the finest indigo. These products, estimating their value only at 25 cents the kilogramme, would yield a net profit which very few trades could equal.

"With respect to the manner in which the operation is effected, it is most simple and easy, and may even be performed by those unacquainted with the first elements of chemistry. The success is certain and expeditious; the implements used in the operation very inconsiderable, and the expense of labor extremely small, since it is not necessary to separate the leaves from the stalks, as the presence of the latter offer no impediment to the success of the operation. M. Bebert, in appreciating the importance of his valuable discovery, will no doubt experience the natural wish that his own country should derive the advantage of it, and by this means increase its riches and prosperity. But if his position or his tastes do not allow him to direct the operations himself; if capitalits unacquainted with manufacturing speculations should not second his views; if, in short, the wish for his country's advantage should give way before so many other difficulties which may be opposed to the establishment of a manufactory of which there has yet been little experience, why cannot this chemist turn towards France for those resources which may fail him in Savoy.

"We are earnestly solicitous that this discovery may be acquired by our country. If France should at some future time enumerate among the elements of her national riches the manufacture of indigo, we should be happy to have been the first to have pointed out the means by which it could be accomplished."

EXTRACTS FROM NEW WORKS.

HISTORICAL NOTICE OF ELECTRICAL DISCOVERY.

BY DIONYSIUS LARDNER, D. C. L. &c.

[Continued from p. 296.]

That the anticipation of the fundamental principle of electro-magnetism, and terrestrial magnetism, should have been complete in all its details, could scarcely have happened at that epoch without something approaching to inspiration; but it will be readily admitted that these guesses of Beccaria, when compared with the discovery of Oersted and the theory of Ampère, form one of the most striking episodes in the history of science.

The analogy between lightning and the electric spark, arising from the peculiar noise or explosion with which each was attended, had been noticed by many electricians. Beccaria, however, investigated and demonstrated its cause, by showing that it proceeded from a pulsation produced in the air by the sudden displacement of that portion of it through which the electric fluid passes. This displacement being transmitted through the atmosphere in exactly the same manner as vibrations are produced by a sonorous body, the sound accompanying an electrical discharge, and the thunder which attends the atmospheric electricity, ensue. Beccaria verified this hypothesis by experiment. He constructed a glass siphon, in one leg of which air was inclosed above a column of mercury, and compressed by the column in the other leg of the siphon. On discharging a Leyden jar through the air thus inclosed, the column of mercury in the other leg was suddenly elevated, and recovered its position after several oscillations.* This fact was also noticed by Kinnersley, the friend and associate of Franklin, but not until a later period.

This was afterwards confirmed by Bouguer and De la Condamine, when they encountered a violent thunder-storm on one of the highest mountains of Peru. The cloud from which the thunder proceeded was placed at but a small distance above their heads. The thunder heard by them consisted only of single cracks, or explosions, like those which attend the discharge of electric batteries, an effect manifestly produced by the proximity of the cause of the sound, and the highly rarefied state of the air at that great elevation.

Contemporaneously with Beccaria, Franklin and Canton, the subject of atmospheric electricity engaged the attention of Lemonnier, who erected an apparatus according to Franklin's method, at St. Germain-en-Laye, with which he showed that sparks were received from the conductor not only in times of storm, but also when the heavens were cloudless. He also first showed that the electricity of the air underwent every 24 hours periodical variations of intensity. Beccaria determined the law of these variations, and was the first who demonstrated that, at all seasons, at all heights, and in every state of the wind, the electricity of an unclouded atmosphere is positive. He found no indications of

* Beccaria, Elettricismo Artificiale. Turin, 1753, p. 227.

electricity in the air in high winds, when the firmament was covered with black and scattered clouds, having a slow motion, in a humid state of the air; but in the absence of actual rain, he found that in changeable squally weather, attended with occasional showers of snow, hail, or rain, the electricity was very variable, both as to its quantity and quality, being sometimes feeble and sometimes intense, sometimes positive and sometimes negative.

Contemporaneously with Beccaria in Italy, Canton prosecuted inquiries in many respects similar, in England, and in various matters of minor importance these philosophers arrived at the same results. The most considerable discovery due to Canton was, that the electricity developed in the friction of the same substance is not always of the same kind. It will be remembered that Dufaye gave the names *vitreous* and *resinous* to the two fluids, on the supposition that each was invariably produced by the friction of the classes of bodies signified by these terms. Canton, however, showed that glass itself was capable of being electrified negatively, and would be always so electrified if the rubber used were the fur of a cat. Canton also (as well as Beccaria) proved that a volume of air in a quiescent state might be charged with electricity. To Canton is also due the discovery of the virtue of the amalgam of tin and mercury, still used with so much effect to augment the development of electricity on glass. The progress of the science had now attained a point at which the great principle of induction could scarcely fail to force itself upon the notice of those engaged in electrical researches. A natural law of the highest order, embracing within the range of its application nearly the whole domain of electrical phenomena, its discovery and development forms an epoch in the history of the science, scarcely second in importance even to that by which Franklin brought meteorology within the legislation of electricity. How much, then, will the veneration in which the memory of the philosopher of the west is held, be increased, if it can be demonstrated, contrary to what has been generally maintained by the historians of the science, that to him is justly owing the honor of the discovery of this physical principle!

Some of the more obvious phenomena of induction were noticed so early in the progress of electrical science, as the researches of Mr. Grey, and many other effects proceeding from it presented themselves to subsequent experimental inquiries, but attracted no attention, and led to no consequences. The first series of experiments, conducted so as to develop in an unequivocal manner this principle, were laid before the Royal Society by Canton, on the 6th of December, 1753.* They consisted chiefly in rendering insulated conductors electrical, by bringing near to one end an excited glass tube, or stick of wax, and exhibiting the varying state of cork balls suspended on the conductor by the alternate approach and removal of the excited electric.

These experiments having been communicated to Franklin, he pursued the inquiry, and succeeded in expressing, in clear and unequivocal terms, the principle of induction; that is to say, in demonstrating that a body charged with either kind of electricity will, on approaching a conductor in its natural state, render that part of such conductor which

* Phil. Trans. vol. xlviii, p. 350.

is nearest to it electrical; that its electricity will be contrary to that of the approaching electrified body; that on removing the electrified body the conductor would be restored to its natural state; all which effects Franklin showed would follow from his theory, by assuming that the electric fluid is self-repulsive, and attracted by the matter of the conductor.

The experiments and reasoning which appear to establish Franklin's right to the honor of this discovery are so concise, that they may be stated here nearly in his own words.

Let a metallic conductor, about five feet long and four inches in diameter, be suspended by dry silk lines, so as to be insulated. From one end of it suspend a tassel consisting of 15 or 20 threads, in a damp state, so as to give them a conducting power. Present an electrified glass tube within five or six inches of the opposite end, and keep it in that position for a few seconds. The threads of the tassel will diverge, and when the tube is withdrawn they will collapse.

While the tube is held near the opposite end of the conductor, and the threads are divergent, present the finger to the end of the conductor at which the tassel is suspended. A spark will be received, and the threads of the tassel will collapse.

Let the tube be then removed. The threads of the tassel will again diverge.

Let the tube be again presented as before. The threads will again collapse, and so on.

Finally, let the tube be presented to the tassel. The divergence of the threads will immediately increase, and continue to increase, as the tube is brought nearer to the tassel.

These phenomena are accounted for by Franklin in the following manner:—"By taking the spark from the end of the conductor, you rob it of part of its natural quantity of electrical matter, which part so taken away is not supplied by the glass tube, and the conductor remains *negatively* electrified. On withdrawing the tube, the electric matter on the conductor recovers its equilibrium, or equal diffusion, and the conductor, having lost some of its natural electricity, the threads connected with it lose part of theirs, and so are electrified negatively, and repel each other.

"When the tube is again presented to the opposite end of the conductor, the part of the natural electricity which the threads had lost is again restored to them by the repulsion of the tube forcing the electric fluid towards them from other parts of the conductor, and thus restoring them to their natural state. When the tube is once more withdrawn, the fluid is again equally diffused, and the threads, as before, are negatively electrified.

"Finally, when the tube is presented to the threads already diverging with negative electricity, still more of their natural electricity is repelled by the excited tube, and the threads are more strongly negative than before, and their divergence is consequently augmented."

Pursuing the principle thus developed still further, Franklin now having restored the conductor to its natural state, presented the excited glass tube to the tassel. The threads immediately diverged.

Maintaining the tube in that position with one hand, he presented the

finger of the other to the tassel. The threads receded from the finger as if repelled by it.

This was explained on the same principle. When the excited tube is presented to the tassel, part of the natural electricity of the threads is driven out of them into the conductor, and they are negatively electrified, and therefore repel each other. When the finger is presented to the tassel, (being then close to the glass tube) part of its natural electricity is driven back through the hand and body, and the finger becomes, as well as the threads, negatively electrified, and so repels, and is repelled, by them. To confirm this, hold a slender, light lock of cotton, two or three inches long, near a conductor positively electrified. You will see the cotton stretch itself out towards the conductor. Attempt to touch it with the finger of the other hand, and it will be repelled by the finger. Approach it with a positively charged wire of a bottle, and it will fly to the wire. Bring it near a negatively charged wire of a bottle, it will recede from that wire in the same manner that it did from the finger, which demonstrates that the finger was negatively electrified as well as the cotton.*

The great principle thus thrown before the scientific world by Franklin, was immediately taken up and pursued through its consequences by Wilke and Æpinus, who carried on their researches together at Berlin. The most important result of their combined labors was the invention of the instrument, which, as subsequently improved under the hands of Volta, became the *condenser*, now so useful in electroscopical investigations.

In applying the principle of induction to the phenomena of the Leyden jar, and to the same effect as exhibited by the oppositely electrified surfaces of a coated plate of glass, these philosophers saw that the negative state of one surface of the glass was, according to the Franklinian theory, the necessary consequence of the positive state of the other. This contrary state of the electricities could only be maintained on the supposition, that glass was impermeable by the electric fluid; and Wilke and Æpinus reasoned, that to whatever extent air or any other body might be similarly impermeable, to the same extent might it be charged on its opposite surfaces. To realize this conception with a plate of air, they coated two large boards of equal size with tinfoil, and suspended them one over the other, leaving a space of about an inch in thickness between them. This space was, in fact, a plate of air, of which the upper and lower surfaces were in contact with the metallic coating of the boards. The lower board communicated with the ground, and a charge of positive electricity was given to the upper one. The lower one then became charged with negative electricity, and when a person touched at the same time the coating of the two boards, the equilibrium was reëstablished, and he received the shock produced by the passage of the electric fluid from the one to the other.

Many curious experiments were exhibited with this apparatus. They found that the two boards, when electrified, strongly attracted each other, and would have rushed together if they had not been prevented by the strings. Sometimes, when the charge was strong, the interven-

* Letters, p. 341. Also, see Phil. Trans. vol. xlix, p. 300.

ing plate of air was not sufficiently impermeable to resist the mutual attraction of the opposite electricities, and a spontaneous discharge would take place through it. They considered these two plates to represent the state of the clouds and the earth during a thunder storm; the clouds being always charged with one kind of electricity, and the earth with the other, while the body of atmosphere between them was analogous to the stratum of air between the two boards. When the charges of the earth and clouds become so strong that the air can no longer resist the passage of the electric fluid through it, a spontaneous discharge ensues, the fluid is seen in its passage by the light it evolves, and the violent displacement of the air produced in its passage causes the thunder.

From these experiments, Æpinus inferred that the phenomena of the Leyden jar was not owing, as Franklin supposed, to any peculiar attraction of the glass for the electric fluid; for, since a plate of air might be charged as well as a plate of glass, that property must be common to them, and was not peculiar to the glass. He inferred, therefore, that this impermeability was a property of all non-conductors; and, since they can all receive electricity to a certain degree, it must consist in the difficulty and slowness with which the electric fluid moves in their pores; whereas, in perfect conductors, it meets with no obstruction at all.*

Æpinus brought to the investigation of the Franklinian theory of electricity those mathematical attainments in which its illustrious founder was deficient. The manner in which that theory had been assailed by its opponents, and defended by its partisans, was such as might have allowed interminable controversy. Æpinus first reduced its principles to exact mathematical statements, with a view to ascertain whether the consequences deducible from them, by rigorous calculation, should be in accordance with the observed phenomena, not only in their general character, but in their numerical quantity. He assumed, according to Franklin's hypothesis, that the molecules of the electric fluid were self-repulsive, and that they were attracted by those of the bodies on which they were diffused. He found, however, that the phenomena could not be explained on these suppositions, unless it were also assumed, that between the matter composing the masses of different bodies there existed a mutually repulsive force, acting at sensible distances. At first he recoiled from an assumption in direct opposition to the known properties of matter; but the necessity for its admission, in order to give consistency and validity to the Franklinian theory, appears at length to have reconciled him to it.

The investigation of the physical relation between the principle of heat and that of electricity, had attracted the attention of experimental philosophers at a very early period in the history of electrical research. Beccaria suspected that heat might itself be an immediate means for the development of electricity, and made some experiments to illustrate this. He soon, however, relinquished the inquiry, concluding that, in cases where the appearance of electricity followed the application of heat, the effect was due to evaporation, or other physical agents, which

* Æpini Tentamen, &c. Petersburg, 1759, pp. 82, 83.

ensued. Priestley observed that heat had some relation to the conducting power of bodies, since by the elevation of temperature, that quality was improved.

A mineral substance, brought from the East by the Dutch navigators, called by the natives of Ceylon, where chiefly it was found, *Tournamal*, and since known as *Tourmaline*, exhibited, under certain circumstances, a property similar to that of amber, and other electrics. But the power was excited in it by mere elevation of temperature. Lemery, the Duc de Noia, Wilson, Priestley, and others, made experiments on this mineral, and published results, in which there was much discordance and contradiction. Æpinus first showed that the attraction and repulsion exerted by this gem when exposed to heat was owing to the development of electricity upon it; and that, when so excited, its opposite sides or ends had contrary kinds of electricity, one being always negative, and the other positive. This was the first case of the distinct exhibition of electrical polarity. Canton observed that the development of the electric fluid upon it was produced only by change of temperature, and that, whenever the gem was broken, each fragment exhibited the same electrical polarity.

At this period effects were observed, which, if chemical science had attained a sufficiently advanced state, could not fail to have led to the discovery of electro-chemistry. Beccaria, by the electric spark, decomposed the sulphuret of mercury, and recovered the metals, in some instances, from their oxides.* Watson found that an electric discharge passing through fine wire rendered it incandescent, and that it was even fused and burnt. Canton, repeating these experiments with brass wire, found that, after the fusion by electricity, drops of copper only were found, the zinc having apparently evaporated. Beccaria observed, that when the electric spark was transmitted through water, bubbles of gas rose from the liquid, the nature or origin of which he was unable to determine. Had he suspected that water was not what it was then supposed to be, a simple elementary substance, the discovery of its composition could scarcely have eluded his sagacity.

After general laws have once been developed, and their application to particular phenomena has become familiar, it appears wonderful that even quick-sighted and acute observers should have had such effects continually reproduced under their eyes, without even making an approach to the discovery of their causes. Franklin found that the frequent application of the electric spark had eaten away iron; on which Priestley observed, that it must be the effect of some acid, and suggested the inquiry, whether electricity might not probably *redden vegetable blues?* Priestley also observed, that, in transmitting electricity through a copper chain, a black dust was left on the paper which supported the chain at the points where the links touched it; and, on examining this dust, he found it to contain copper.

Some years after the invention of the Leyden jar, when the necessity of some sufficient indicator of the presence of electricity, and some visible measure of its power became apparent, the invention of electrometers engaged the attention of electricians. After several abortive

* Lettre del Elettricismo, § 341, p. 282.

attempts on the part of others, the Abbé Nollet proposed the simple expedient of suspending two threads, which, when electrified, would separate by their mutual repulsion. Cavallo afterwards improved upon this, by substituting two pith balls, suspended in contact by fine metallic wires, an apparatus still used. After this, various forms of electroscopic instruments were suggested and constructed by Volta, Saussure, and others, all depending on the principle that the intensity of the electric fluid was manifested by the force of its attraction or repulsion exerted upon light substances to which it was imparted.

The principle of induction applied to the *air-condenser* by Wilke and Æpinus, was taken up by Volta, and applied, first, to the construction of the electrophorus, and subsequently to the common condenser, which, combined with the electroscope, became in electricity an instrument of investigation analogous in its character and importance to the compound microscope in optics.

The manner in which the electrified fluid is distributed upon insulated electrified conductors next became the subject of inquiry. Beccaria showed that its distribution is superficial, and that the internal parts of the electrified body are in their natural state. It was showed that, whether the electrified conductor were hollow or solid, the electricity contained on it was the same. Lemonier first showed that the form of the conductor had an influence on the quantity and the distribution of the fluids.

In 1778 Volta published a memoir on this subject, in which he proved, that of two cylinders of equal superficial dimensions, that which had the greater length would receive, *cæteris paribus*, the stronger charge, and inferred that great advantage would arise from the substitution of a system of small cylinders for the large conductors of electrical machines. About the same period, he showed how inflammable gases could be ignited in close glass receivers by the electric spark, the apparatus for which purpose soon grew into his *eudiometer*, for the analysis of gases. Soon after this, the same apparatus supplied the means of inflaming a mixture of oxygen and hydrogen gas, which led to the discovery of the composition of water.

In the year 1759 appeared the "Philosophical Transactions," a series of papers by Mr. Robert Symmer, which are entitled to be recorded in the history of electricity; not so much on account of what they describe, as for the theoretical views developed in them. The experiments of Symmer consisted chiefly in exhibiting, by striking examples, the effect of the mutual attraction of bodies, electrified by opposite kinds of electricity. These results led him to doubt the sufficiency of the Franklinian theory, then and long afterwards universally received, to explain satisfactorily the phenomena; and he was led to consider whether the hypothesis of Dufaye might not be so modified as to explain them more adequately. Dufaye, as has been already stated, assumed the existence of two independent electric fluids, which he supposed to be latent in two distinct classes of bodies, the one in bodies of a vitreous, and the other in bodies of a resinous nature; and that these fluids, while they were each self-repulsive, were mutually attractive of each other.

It was obvious that such an hypothesis was quite inconsistent with the phenomena of electricity, even limited as they were in variety at the

period now referred to. Symmer retained the supposition of Dufaye so far as regarded the assumed existence of two distinct fluids mutually attractive, but he maintained that these fluids were *not* independent of each other. On the contrary, he assumed that they were always co-existent in bodies not electrified; that, by their mutual attraction, they held each other in subjection; that every body in its natural state contained equal quantities of these fluids, each molecule of the vitreous fluid being combined with a molecule of the resinous fluid, the compound molecule thus formed exciting neither attraction nor repulsion on the other parts of the natural fluid.

This theory of two fluids was left by its author unsupported by any extensive application to the phenomena which could be expected to shake the confidence then generally given to the hypothesis of Franklin; and although it is noticed at some length in his History of Electricity by Dr. Priestley, it obtained no countenance or support until further advances in electrical experiments rendered apparent the defects of the theory of a single fluid. It may be here observed, that the French writers generally ascribe the theory of two fluids to Dufaye, and are silent as to Symmer's share in it; with what justice will be apparent from what has been above stated.

In the year 1770, Dr. Priestley published his works on electricity. This philosopher did not contribute materially to the advancement of the science by the development of any new facts; but in his History of Electricity he collected and arranged much useful information respecting the progress of the science. At this period, the Hon. Henry Cavendish, whose name has been distinguished in other departments of physics, engaged in some original investigations respecting electricity. The discovery of the composition of water, by transmitting an electric spark through a mixture of oxygen and hydrogen gases, has been generally ascribed to him.* Cavendish conceived the notion of reducing the phenomena of electricity to mathematical analysis, and had proceeded with a memoir on that subject, which was completed before he learned that Æpinus had produced a work with the same object. On comparing his own paper with the *Tentamen* of Æpinus he found that they were nearly similar. Nevertheless, Cavendish published his memoir.

The year 1785 formed an important epoch in the history of electrical science, marking, as it did, the commencement of those labors by which Coulomb laid the foundations of electro-statics. This great experimental philosopher was the first who really brought the phenomena of electricity within the reach of numerical calculation, and thereby prepared the way for his followers in the same field to reduce this most subtle of all physical agents to the rigorous way of mathematics. It is to Coulomb we owe it, that statistical electricity is now a branch of mathematical physics.

The immediate instrument by which this vast object was attained, was the *balance of torsion*, which he had already used with signal success in other delicate physical inquiries. This apparatus, which will be fully explained in the following work, consisted of a needle suspended in a horizontal position by an extremely fine wire or filament of silk

* This claim has been recently called in question.—See Lardner on the steam-Engine. Seventh edition, p. 303.

attached to its centre of gravity. The attraction or other force of which the intensity is required, is made to act on one end of this needle, so as to twist the filament by which it is suspended; and it is resisted in its effort to effect this by the reäction proceeding from the torsion so produced. This reäction, and therefore the force which produces it, and is in equilibrium with it, was proved by Coulomb to be proportionate to the angle described by the needle round its centre of motion. Such was the sensibility of this exquisite instrument, that it was found to be perceptibly effected by a force, not exceeding the twenty-millionth part of a grain.

With this instrument Coulomb measured the force with which electrified bodies attract and repel each other, and the first result of his investigation was the discovery, that the law of this attraction and repulsion was the same which Newton showed to prevail among the great bodies of the universe. In fact, he showed that two bodies, oppositely electrified, attract each other with a force which, *cæteris paribus*, is the same at equal distances, and which augments in the same proportion as that in which the square of the distance is diminished. Also if two bodies be similarly electrified, they will repel each other by a force which increases according to the same proportion when the distance between them is diminished.

By attaching a very small circular disc of paper coated with metallic foil to an insulated handle, Coulomb found, that, by touching with the face of the disc an electrified surface, and then submitting the disc itself thus electrified by contact to the test of the balance of torsion, he could determine the depth of the electric fluid on the surface touched by the disc. In this manner was he enabled to *guage* or *sound* the electricity on the surface of bodies, so as to compare numerically its depth on different bodies, or on different parts of the same body.

With this instrument he measured the proportion in which electricity was shared between insulated conductors when brought into contact, and also the law according to which its depth varied on different parts of the same insulated conductor. These results acquired, at a later period, still greater importance, supplying, as they did, tests by which the mathematical analysis of the science could be tried.

The same apparatus supplied the means of investigating the law, according to which an insulated electrified conductor had its charge gradually diminished by dissipation in the surrounding air, and by the escape of the fluid by the imperfect insulation of the supports.

The results of the observations of Coulomb on the distribution of the electric fluid on the surfaces of conductors, illustrated satisfactorily the doctrine of points which formed so prominent a part of Franklin's researches. The theoretical solution of this problem was not, however, effected till a later period.

The demonstration of the identity of lightning and electricity naturally directed the attention of philosophers to the solution of other meteorological phenomena by means of the same agency. The explanation of the *aurora borealis* had long exercised the sagacity and baffled the attempts of those devoted to physical researches. Some ascribed this appearance to solar light refracted in the higher regions of the air, others assigned it to the agency of the magnetic fluid. Euler imagined it to

proceed from the same ether which formed the tails of comets: Marian conceived it to arise from the mixture of the atmosphere of the sun with that of the earth; but when the properties of electric light became known, and when its appearance in rarefied air had been observed, all these hypotheses were by common consent abandoned, and no doubt was entertained that, whatever might be the details of the natural process by which it was produced, the *aurora borealis* was an effect of atmospheric electricity. Eberhart, professor at Halle, and Paul Frisi at Pisa, were the first who proposed an explanation of it, founded on the following facts:—1, "Electricity transmitted through rarefied air exhibits a luminous appearance, precisely similar to that of the aurora borealis." 2. "The strata of atmospheric air become rarefied as their altitude above the surface of the earth is increased. Hence they argued that the aurora is nothing more than electrical discharges transmitted through parts of the upper regions of the atmosphere, so rarefied as to produce that peculiar luminous appearance which they exhibit. This theory, which was embraced and improved in its details by Canton, Beccaria, Wilke, Franklin, and other contemporary electricians, has received further countenance from more recent researches.

Attempts were also made to explain on electrical principles other meteorological effects; such as waterspouts, whirlwinds, rain, fogs, hail, &c., but no satisfactory conclusions resulted from these investigations, and the discussion of such phenomena forms a part of the meteorological inquiry of the present time.

While the series of experimental researches which have just been related were in progress, many attempts were made to trace electricity in the phenomena of vegetable and animal life, and more especially to apply it as a medical agent in cases of organic disease in the animal system. None of these attempts, however, led to any consequences sufficiently important to entitle them to attention in this brief sketch.

After electroscopes had been much improved, and in their application to atmospheric electricity had derived great power from the addition of a long pointed conductor, extending from the diverging balls to a height of several feet, Volta engaged in the investigation of the electric state of the air. He substituted for the suspended balls two blades of dry straw, hanging in contact and communicating with the lower end of the conducting rod. In addition to this, he had recourse to another apparently strange and unusual expedient. He placed on the point of the rod a taper or lamp, so as to cause this conductor to terminate in a flame. He contended that the flame attracted to the point of the conductor three or four times as much electricity as would be collected in its absence. This was explained by the effect of the vertical current of air which the flame maintained directly over it, which established a better communication between the metallic conductor and the strata of air above it.

Assuming this property of flame, Volta argued, that since fires robbed the atmosphere above them of electricity faster and more effectually than metallic points, it must follow that to prevent coming storms, or to mitigate their force, the best expedient would be to light enormous fires in the middle of extensive plains, or better still, on elevated stations. If the effects of the lamp on the atmospheric electrometer be

admitted, there seems to be nothing unreasonable in the supposition that large fires may, in a short interval of time, rob immense volumes of air and vapor of their electricity.

Volta wished to submit this theory to an experiment on a large scale, but was not able to carry the design into effect. M. Arago suggests, that by making suitable meteorological observations in those parts of Staffordshire and other English counties which abound in vast iron furnaces, where fires of extraordinary magnitude are maintained night and day, and comparing the results with similar observations made in adjoining agricultural districts, the conjecture of Volta might be tested.*

It has been already stated, that direct observations proved that the atmosphere, in its ordinary condition, is always charged with positive electricity. The beginning of the year 1780 was signalized by a capital experiment, by which it was proved that the source from whence this vast amount of the electric fluid was derived, or to speak more correctly, the cause of the disturbance of the general equilibrium of the globe, which gives a surplus of the positive fluid to the air, and leaves the air earth surcharged with negative fluid, and which, in its effects, assumes all the terrific forms of the tempest and the hurricane, and probably of many other violent convulsions which are occasionally exhibited in the war of the elements, is to be found in the process of natural evaporation which continually maintains its silent and imperceptible progress upon the surfaces of ocean, lake, and river, and even from those of organized bodies. That heat passes off in a latent form by such means, and equalizes and moderates the general temperature around us, was well known; but it was not suspected that the elements of the storm, the corruscations of meteoric light, and splendors of the aurora, were due to the same cause.

Volta states, that in the year 1778 this idea occurred to him, and that he conceived the notion of an experiment by which it might be brought to an immediate trial. Let a metallic dish filled with water be placed on an insulating support, and exposed in the open air until it evaporates, the dish being maintained in communication with a sufficiently sensible condensing electroscope. If, in evaporating, the positive fluid be carried off, the dish will, after the evaporation, be negatively electrical, and the electroscope will show it; and if not, the electroscope will give no sign. Various circumstances prevented Volta from trying this experiment until the month of March, 1780, when, being in Paris, he succeeded, *in company with* some members of the Academy of Sciences. There appears, nevertheless, to remain some doubt as to the share which Volta really had in this famous experiment, since, in the account of it published by Lavoisier and Laplace, it is related as performed by them, and Volta is mentioned incidentally as being present on the occasion.†

After the phenomena of electricity had, by the labors of Coulomb, been reduced to exact numerical estimation, this branch of physics was in a state to permit its being brought within the pale of mixed mathematics. To accomplish this, it was necessary to express, by mathematical formulæ, the intensity of the electric fluid on different parts of insulated conductors of given figures, placed either separately, or in such a position as to exercise an electrical influence upon each other

* Eulogo de Volta, p. 18. † Ib. p. 21.

without contact, or, finally, when placed in actual contact. To establish such formulæ, it was necessary to assume some definite hypothoeses as the law of electrical action. The Franklinian theory of a single fluid appeared to be incapable of affording the means of explaining, with numerical precision, the state of such bodies. It is true, that this long received hypothesis was sufficient to account, in a general way, for the electrical state of bodies under the ordinary circumstances of their mutual action; but when vigorous numerical accuracy was demanded, when not merely the general circumstances of the dense accumulation of electricity in one part of the surface, its more feeble intensity at another, its total absence from a third place, or the presence of electricity on a certain side of a conductor and positive electricity on another, were severally demanded; but when it was required to determine the exact numerical measure of the depth of the fluid at each particular spot on a given insulated conductor, placed under given conditions with reference to others, so that such numerical measure, so obtained by calculation, might be compared with the actual depth observed by the instruments invented and applied by Coulomb, then this theory appeared to fail; at least, none of its advocates produced any such calculations. La Place investigated, on mathematical principles, the distribution of electricity on ellipsoids of revolution, assuming, as the basis of his reasoning, the hypothesis of two fluids. Biot also investigated the same problem applied to spheroids of small eccentricity; but the general subjugation of this portion of electrical science to mathematical analysis is due to Poisson.

This illustrious analyst took as the basis of his investigations the theory of two fluids proposed by Symmer and Dufaye, with such modifications and additions as were suggested by the researches of Coulomb. He regarded the mutual attractions and repulsions exhibited by electrified bodies, not as real forces exercised by those bodies, but as altogether due to the electric fluids with which they are charged. The laws of attraction and repulsion developed by Coulomb are therefore assumed as those of the electric fluids. The particles of each of these fluids are assumed to repel each other with a force varying according to that law, while the particles of each fluid attract those of the contrary fluid by a force governed by the same law. These conditions are sufficient to supply the mathematical formulæ necessary to the determination of the depth and quality of the electric fluid on every part of the surface of a body of given figure placed under any given electrical conditions. The electric fluids of either kind would, by virtue of their self-expansive property, escape from the surface of the body on which they rest; but this is prevented by the pressure of the surrounding air, which retains them in their position so long as their expansive force is less than that pressure. On bodies of elongated forms, or those which have edges, corners, or points, it is shown as a consequence of this theory, that the electric fluid accumulates in greater depths about the ends, edges, corners, or points, than in any other places. Its expansive force at such parts is therefore greater than elsewhere, and will exceed the atmospheric pressure, and escape when at other parts of the surface it is retained.

This theory will be explained in the present work, as far as its development is consistent with the object of these volumes. It will not,

therefore, be needful to enlarge upon it further in this place. It may, however, be asked why it is, seeing that the theory of two fluids is sufficient for the explanation of all the phenomena to which it has yet been applied, and that, on the other hand, the theory of a single fluid fails to afford any satisfactory or accurate explanation of so many phenomena, the latter theory nevertheless still has followers, and that even among electricians, whose opinions cannot be regarded otherwise than with sentiments of respect, it is still clung to as the hypothesis best entitled to reception and confidence? It is not easy to assign any sufficient reason for this, unless one can be found in the profound and abstruse nature of the mathematical principles, by the aid of which alone the effects are capable of being expressed. When it is remembered that, until very recently, electricity was regarded as exclusively a part of experimental physics: that researches in it were chiefly carried on by persons engaged in chemical investigations; that from the nature of their studies and pursuits, such persons rarely cultivated even the elements of mathematics, and almost never pursued analytical science into those more profound studies which are now indispensable for the solution of the class of problems which electricity has presented, it cannot be matter of much surprise that reasoning, which is incapable of being expressed save by symbols, of which the force and import must be unintelligible to the great mass of such persons, should fail to carry conviction to their understanding. To arrive at such conviction, they must either commence their education anew, or be content to receive those new doctrines on their faith in the assurances of those who are capable of investigating them. Either side of such an alternative is never very willingly embraced.

Having never followed the progress of discovery in this part of electrical science to that point at which all subsequent researches must be regarded as the labor of our contemporaries, the province of the historian ceases. Whatever has been effected more recently will properly form a part of the subject matter of the volumes now presented to the reader, of which it is hoped that a brief exposition and analysis of the researches of contemporary philosophers will form not the least interesing and useful portion.*

II. *Electro-Dynamics.*—The investigation of the mechanical phenomena of material substances has been in modern works conducted by resolving these effects into two principal divisions, those in which the bodies exhibiting them are at rest, and those in which they are in motion. As applied to solid bodies, these divisions have been respectively denominated *statics* and *dynamics;* and, as applied to fluids, *hydrostatics* and *hydrodynamics.* Electricity being assumed to be a physical agent, having the properties of an elastic fluid, and capable, like the grosser solids and fluids, of being maintained in a state of equilibrium by the mutual action and reäction of antagonist forces, or of moving in definite directions, and forming currents of greater or less intensity, the analysis of its effects would naturally be conducted by means of the same classification; and, accordingly, that division of the science in which the

* It must be borne in mind by the readers of this Journal, that the volumes now referred to form a Manual of Electricity, to which this historical notice is only an introduction.—*Ed. Am. Rep.*

electric fluid is considered in a state of equilibrium or repose, and in which the physical conditions on which such equilibrium depends are investigated, would be denominated *electro-statics*, while that in which the effects of the currents of electricity are considered, would be called *electro-dynamics*.

Rest being in its nature more simple than *motion*, and the cases of forces mutually destructive of each other's influence, and therefore productive of equilibrium, being more simple than those in which motion ensues from the combined action of forces differing from each other in various respects, it was natural that, in every part of physics, the principles of statics should be first established and understood. Such has been accordingly the course which the progress of discovery has taken in other branches of natural philosophy, and electricity is not an exception to it. All the phenomena which have been hitherto adverted to in this notice belong properly to *electro-statics*. In all of them the electric fluid contemplated in a state of equilibrium, or if its motion be occasionally considered, it is only in sudden and momentary changes from one state of equilibrium to another. Thus, when a Leyden jar is charged, the positive electricity accumulated on the inner surface of the glass is maintained there in spite of the tendency it has to escape in virtue of its self-expansive property by the attraction of the negative electricity accumulated on the external surface. When a communication is made between the internal and external surfaces by a metallic wire, this state of equilibrium ceases, the positive fluid of the inner surface runs along the wire in one direction, and the negative fluid of the external surface runs along it in the other direction, until each neutralizes the other, and a new state of equilibrium is established by the actual combination of the two fluids. If this change occupied a sensible interval of time, and it were required to investigate the effects which would be produced during that interval either on the jar and wire, or on any bodies which might be within their influence, the question would properly belong to *electro-dynamics;* but in fact the discharge, as it is called, or the transition from the one state of equilibrium to the other, is instantaneous, and the same may be said of all the phenomena which form the subject of the preceding pages.

In the commencement of this notice, the frequent influence of circumstances, apparently fortuitous, on the progress of discovery in the sciences has been mentioned. It would be difficult, either in the history of the sciences or of the political growth of states, to find a more signal example of this than was offered by the discovery of the most powerful instrument of physical investigation, the *voltaic pile*. "It may be proved," says M. Arago, "that this immortal discovery arose in the most immediate and direct manner from a slight cold with which a Bolognese lady was attacked in 1790, for which her physician prescribed the use of *frog broth*."

Galvani was professor of anatomy at Bologna. At the period just mentioned, it happened that several frogs, divested of their skins and prepared for cooking the broth prescribed for Madame Galvani, lay upon a table in the laboratory of the professor, near which at the moment stood an electrical machine. One of the professor's assistants, being employed in some process in which the machine was necessary, took

sparks occasionally from the conductor, when Madame Galvani was astonished to see the limbs of the dead frogs convulsed with movements resembling vital action. She called the attention of her husband to the fact, who repeated the experiment, and found the motions reproduced as often as the spark was taken from the conductor. This was the first, but not the only or chief part played by chance in this great discovery.

Galvani was not familiar with electricity. Had he been so, he would have seen in the convulsions of the frog evidence of nothing more than a high electroscopic sensibility in the nerves of that animal, and an interesting example of the known principle of *electrical induction*. But luckily for the progress of science, he was more an anatomist than an electrician, and beheld with sentiments of unmixed wonder the manifestation of what he believed to be a new principle in the animal economy, and, fired with the notion of bringing to light the proximate cause of vitality, engaged with ardent enthusiasm in a course of experiments on the effects of electricity on the animal system. It is rarely that an example is found of the progress of science being favored by the ignorance of its professors.

Chance now again came upon the stage. In the course of his researches he had occasion to separate the legs, thighs, and lower part of the body of the frog from the remainder, so as to lay bare the lumbar nerves. Having the members of several frogs thus dissected, he passed copper hooks through part of the dorsal column which remained above the junction of the thighs, for the convenience of hanging them up till they might be required for the purposes of experiment. In this manner he happened to suspend several upon the iron balcony in front of his laboratory, when, to his inexpressible astonishment, the limbs were thrown into strong convulsions. No electrical machine was now present to exert any influence.

If the supply of capital facts be occasionally due to chance, or to the Being by whom what is miscalled chance is directed, it is to the operation of the faculties of exalted minds upon those naked facts that the development of the laws of nature is due; if rude lumps of the natural ore of science be now and then thrown under the feet of philosophy, the discovery of the vein itself, its depth and direction, its quality and value, the separation of the precious metal it contains from its baser elements, the demonstration of its connection with the phenomena of nature, and its adaptation to the uses of life, are all and severally the work of that noble faculty of intellect, that image of his own essence, which the Creator of the universe has impressed upon man, and which is never more worthily exercised than in the investigation of those laws of the material world, in all of which, whether they affect the vast bodies of the universe, or the imperceptible molecules of those around us, there is ever conspicuous a provident care for the well-being of his creatures.

In the convulsions of the frog, suspended by a copper wire on an iron rail, Galvani saw a *new fact*, and soon discovered that the circumstance on which it depended was the simultaneous contact of the metals with the nerves and muscles of the animal. He found that the effects were reproduced whenever the muscles touched the iron while the nerves touched the copper, but that contact with the copper alone did

not produce them. He next placed the body of the animal upon a plate of iron, and touching the plate with one end of a copper wire, brought the other end into contact with the lumbar nerves. The convulsions followed as before. Galvani inferred from these and other similar experiments and observations, that the conditions under which the phenomena were produced were, that a connection should be made between the nerves of the animal and the muscles with which those nerves were united by a continued line or circuit composed of two different metals; and he explained this singular effect by assuming, hypothetically, that, in the animal economy, there exists a natural source of electricity; that at the junction of the nerves and muscles, the natural electricity is decomposed; that the positive fluid goes to the nerve, and the negative to the muscle; that the nerve and muscle are therefore analogous to the internal and external coating of a charged Leyden jar; that the metallic connection made between the nerve and the muscle in the experiments above mentioned, serves as a conductor between these opposite electricities; and that, on making the connection, the same discharge takes place as in the Leyden experiment.

This theory fascinated for a time the physiologists. The phenomena of animal life had been ascribed to an hypothetical agent, which passed under the name of the "nervous fluid." The galvanic theory consigned this term to the obsolete list, and electricity was now the great vital principle, by which the decrees of the understanding, and the dictates of the will, were conveyed from organs of the brain to the obedient muscles of the body. Those who know how passionate is the love of a theory which appears to give a satisfactory account of effects otherwise mysterious, and how much more gratifying to the *amour-propre* it is to be able to connect effects with supposed causes, than to be compelled to view the former as the real limits of our knowledge, will understand the reluctance with which the Bolognese School and its distinguished leader would surrender a theory so dazzling as animal electricity; nevertheless, it was doomed soon to fall under the irresistible assaults of physical truth directed against it by a giant intellect, which though located in a little village of the Milanese, belonged to mankind

Volta, professor of natural philosophy at Como, and subsequently at Pavia, had been already known for his researches in different parts of physics, but more especially in electricity. The Bolognese experiments naturally engaged his attention, and it was not long before his superior sagacity enabled him to perceive that the theory of Galvani was destitute of any sound foundation. Indeed, a single experiment was sufficient to overturn it, though not to carry conviction of its futility to the minds of its partisans. Volta applied the metals in contact with each other to the muscle alone, without touching the nerves, and the convulsions nevertheless ensued. The analogy of the muscle and nerve to the Leyden phial was no longer tenable. Volta transferred this analogy to the two metals, and contended that the mutual contact of two dissimilar metals must be regarded as the source of the electricity; that by the contact, the natural electricity was decomposed, and the positive fluid passed on one metal, and the negative one on the other; and that the muscle merely played the part of a conductor in carrying off one of the fluids thus developed.

(TO BE CONTINUED.)

MISCELLANEOUS.

The Mammoth Iron Steamer.—The first idea of those who hear of an iron ship is, probably, of something amazingly strong, but so heavy as to be kept afloat with difficulty, and liable to go down "like a stone," as the sailors term it, the moment she has the misfortune to spring a leak. Now all this is pure imagination; and it only requires to inspect an iron vessel while under the builder's hands to have every prejudice on the subject removed, and to ascertain, that so far from being heavier and more liable to sink, the weight of an iron vessel, built of the same degree of strength as one of wood, the external dimensions of both being equal, will be something less than half that of the latter, the proportion being, we believe, on an average, about as 7 to 16. A strong wood-built vessel is estimated to weigh, at least 1600 weight to every register ton; the new iron ship, building at Bristol, about 700 weight; or, in other words, supposing a wood-built vessel of the same size as the Great Western Company's new iron steamship, and both to be loaded with the same weight of cargo, the iron ship might take in 1400 tons of water by leakage before she would come to the same bearings as the other.

Not only, however, is the iron ship superior in lightness, but she is also far less liable to spring a leak at sea than a wood-built vessel. There is scarcely a plank in an ordinary ship which is not forced into its place, more or less, contrary to the position it would maintain if left to itself, and this is particularly the case round the bows and in the run of the vessel, where, after being softened and rendered pliant by saturation from steam, it often requires considerable mechanical power to bring the planks to what is technically called "their berth."

Again, every plank, however firmly bolted to the timbers within, is quite independent of, and unconnected with, those above and below it; the consequence of which is, that every wood-built vessel has a tendency to strain at sea whenever, as it is often needful to do, an unusual press of canvas is carried on her. The masts in this case acting as a powerful lever on the upper works, with which they are connected by the deck and beams; and the ballast or cargo below endeavoring to maintain its position by its *vis inertia*, it becomes evident that in proportion as the vessel heels over from the force of the wind, so much greater must be the strain on her weather or upper side; and this having a direct tendency to open the seams between the planks, it is by no means uncommon for vessels to leak under such circumstances which had previously shown no symptoms of complaining; and oftentimes the fastening works loose, treenails and bolts are partially drawn, butts started, and the vessel becomes leaky and unseaworthy, however new, until she has again been overhauled by the shipwrights. All old sailors are perfectly aware of this, and are never caught by a storm, on a lee shore, without keeping a watchful eye on the pumps as well as the sails. But in the case of an iron-built vessel it is entirely different; every separate sheet of iron with which she is closed in is adapted to its particular situation, from which it has no tendency to remove itself except that

which it naturally derives from gravitation; and as every sheet is bolted in the firmest manner into all those to which it adjoins, above, below, and laterally, as well as to the iron ribs, or frame on which they are laid, the vessel may be considered almost as compact as a cylinder; and we should no more expect to find her leak by straining at sea than we should expect to see the bilge-plank of a wood-built vessel open through its centre under similar circumstances.

To supply the place of a kelson, ten distinct rows of plates are fixed to run the whole length fore and aft on the bottom, above two feet deep, and something less than that apart, the whole being united by a number of bonds in the form of the letter U, the bottom of which is fastened into a flooring iron, and the sides to the two plates between which it stands; thus with superior lightness securing the same strength, and distributing the support so as to meet the strain on the bottom, wherever it may occur. To insure the safety of the vessel, and prevent her from being subject to wreck at sea, from whatever cause, she will be divided into separate compartments, each of which will be water-tight, and any two of them capable of supporting the entire weight of the vessel with considerable buoyancy, so that if she ran into an iceberg, or were thrown upon a rock, she would not be liable to go down, or endanger the lives of the passengers, as long as one end of her remained unbroken. To this may be added the power of her pumps, which will be enabled, in case of any serious leak, to throw off a quantity of water exceeding 7000 gallons, or 25 tons per minute; so that a leak which would in five minutes sink a loaded ship of the size of 300 or 400 tons, would merely keep the pumps of this steamer briskly at work, to prevent the water from gaining on her. In fact, when the ship is fairly afloat, with good canvas aloft, and the screw-propeller below, she may be pronounced to be the most safe and complete nautical machine with which mankind were ever yet acquainted. Polytechnic Jour.

New mode of preparing Skins for Gelatine, &c. and for Tanning.— The skins and other animal substances are first divested of hair, and this is effected by placing them in a solution of lime, potass, or soda, or combined portions of either, dissolved in water, in the proportion of from 8 to 26 lbs. of lime, and from 4 to 16 lbs. of potass or soda, to every 50 gallons of water: they remain in this 24 hours, by which time the hair will be slightly loosened. The animal substances, together with a quantity of the solution, are then placed in a rotating cylinder, formed of bars of wood or metal set at short distances asunder, and secured to strong circular ends of from two to four feet in diameter, (or instead of the bars a perforated surface of wood may be used) the cylinder being placed in a case or trough of any suitable material. The cylinder continues revolving until, by the action of the lime, potass, or soda, aided by the friction of the internal surface of the cylinder and the animal substances against each other, the hair is removed, together with some of the albumen which such animal substances contain. They are then taken out of the cylinder, and after being fleshed or shaved in the usual way, are washed and soaked in water until thoroughly cleansed.

The substances are now steeped in a large vat, and allowed to remain in the water until a slight putrescence is evident. They are then re-

moved to suitable receivers, in which they are covered with water, and upon them is poured from 6 to 28 or 30 lbs. of hydrochloric acid for every cwt. of animal substances that the receiver contains, or the acid, in either of these proportions, may be mixed with a sufficient quantity of water in a separate vessel, and poured upon the animal substances, which are stirred round, in order that the mixture may have access to all parts of their surfaces. The vessel is then covered over, and the substances exposed to the action of the acidulated water for a suitable time, varying from 8 to 24 hours; the skins and other animal substances generally assuming a white semi-transparent appearance when they had been exposed a sufficient time to the action of the mixture.

The substances are next thoroughly washed in cold water, and deposited in a tank, through which a current of fresh water is constantly flowing. They remain in this two or three days, and are then ready to have the gelatine, size or glue extracted from them.

Instead of the hydrochloric acid in solution, the substances may be exposed in a close vessel to the action of hydrochloric acid gas, or to the action of the same gas, disengaged, and absorbed by water.

Hides or skins intended to be tanned are subjected to the above processes, and after that they are tanned in the ordinary way. Inv. Ad.

Improved Stocking Machine.—The improved machine consists of a rectangular frame standing upon feet, on the front rails of which two sets of brackets are attached, carrying the principal working parts. In the front part of the machine are a series of vertical jacks or levers, vibrating upon a horizontal shaft, between combs, which are fixed to the lower set of brackets. To the upper end of each jack a lead with two needles is connected by a joint, the leads sliding in and out horizontally upon the top rail of the machine, and the lower ends of the jacks are acted on by springs, which, pressing against the tails of the jacks, force their lower ends back, and thus cause the needles to be projected forward. The tails of the jacks are acted on by a series of tappets, set as oblique steps on the periphery of a barrel or cylinder, which is mounted on a horizontal shaft at the centre of the machine. These tappets, by the revolution of the cylinder, are made to act on the tails of the jacks, in order to draw back the needles at the required periods one after the other.

The bobbin, containing the thread for the production of the fabric, is placed above the machine, and from thence the thread passes down through the eye of a thread-carrier to the needles.

From the front ends of the upper set of brackets a lever frame is suspended by joints, carrying a bar, to which a series of points set in leads are attached. These points stand between the needles, and are used instead of the ordinary sinkers, for the purpose of forming the loops. To the front end of these brackets, likewise, two other levers are attached by joints, carrying a presser bar. To the under parts of these brackets a vertical bar, called the stump bar, is fastened, the upper edge of which is cut into notches, and between these notches the needles slide to and fro; in front of this bar, below the needles, a thin plate, called the freeing plate, is attached, a space being left between the two for the work to pass down to the work-beam below. Ib.

Improvement in Line Engraving.—The improvement consists in engraving a subject upon two steel or other metal plates, one portion of the subject on one plate, and the remainder on the other, so that when printed one upon the other, as the same surface, the combination of the two impressions will produce the representation required.

Two plates are prepared for engraving, and on one of these is put a tracing or rolling off of any given subject. The necessary outline and dark shadows of the subject are then etched on this plate, and such portions of the subject are then finished by the usual process of line engraving. This plate is called the subject plate.

On the other plate a tracing or transfer from the first-mentioned plate is placed, and a tint of lines is ruled all over the subject with a machine; the lights are then stopped out, and the under tints or shadows are produced by biting-in. This plate is called the ground plate. The shadows may be deepened by etching or graving, if necessary, and the lights may be brightened by burnishing.

The plates being now marked with register lines, may be printed one upon the impression given by the other, so as to produce the effect desired. Ib.

Botanical Science.—At a late meeting of the Botanical Society of London, a paper was read by Rev. C. A. Johns, "on the luminosity of Schistostega pennata, &c." This moss was found by the author on the roof of a cave, where it possessed to all appearance a luminous property. He found that near the mouth of the cave, where the plants were perfectly dry, there was *no* luminous appearance. On the contrary, wherever the leaves were tipped with globules of condensed vapor, there light was reflected; but he also found that on passing his hand over the luminous mass, and by so doing removed the globules of fluid, all tendency to reflect rays of light was destroyed; hence, he could but conclude that the plant was not in itself phosphorescent, and that whatever light was reflected came not from the globular cells of the plant, but from the globules of fluid resting on it. It then became a matter of inquiry, do other plants possess the same property under similar circumstances? This question was shortly answered in the affirmative, for other mosses growing with it, such as Hypnum prælongum, and two species of Jungermannia, exhibited the same phenomena; hence, says the author, it would appear that those species of cellular plants, which are furnished with *reticulated* leaves when growing in damp situations, to which few rays of light can penetrate, have a tendency to reflect from the globules of fluid condensed on their leaves, rays tinged with the color of their own substance. Ib.

The Periodical Meteors.—Sir John Herschell has addressed the following letter to the Athenæum in reference to the periodical return of meteors in August and November:—

"The bright moonlight of the 9th inst. having prevented my obtaining satisfactory observations of the meteors, to whose periodical return on the 9th and 10th of this month Professor Quetelet has drawn much attention, as being more regular than the displays of the 12th and 13th of November, allow me, in place of observations for the current year,

to offer as my contribution to our stock of knowledge on the subject, the following incidental mention of such an occurrence, which occurs in Sir W. Hamilton's account of the great eruption of Vesuvius in August, 1799, printed in the Transactions of the Royal Society, vol. 70, which will be read with the more interest, the periodical nature of the phenomena being then unknown, and its occurrence being ascribed by him to some local electrical agency developed by the volcanic ejections. 'August 9, 1799,' after describing the phenomena of the eruption during the day till 7 o'clock at night, 'when all was calm,' Sir W. Hamilton goes on to say, 'it was universally remarked, that the air this night, for many hours after the eruption, was filled with meteors, such as are vulgarly called falling stars. They shot generally in a horizontal direction, leaving a luminous train behind them, but which quickly disappeared. The night was remarkably fine, starlight, and without a cloud. This kind of electrical fire seemed to be harmless, and never to reach the ground, whereas that with which the black volcanic cloud of last night was pregnant, appeared mischievous, like that which attends a severe thunder storm.' The meteors of August 9, 1840, in so far as I observed them, radiated almost without exception from a point in the heavens very near the star Gamma, in the constellation Perseus; which is almost coincident with the point, (near the star B Cameleopardali) from which I observed them to emanate on the 10th of August, 1839. Facts of this nature appear almost decisive in favor of the opinion that a zone or zones of these bodies revolve about the sun, and are intersected by the earth in its annual revolution."

Improvements in Weaving, &c.—The first improvement consists in a mode of constructing and applying apparatus to looms to facilitate the change of pattern.

To the end framing of the loom a frame is fixed, containing a series of sliding bars, which move vertically in the same, being guided in openings in the upper and lower part of the frame. Each bar has two recesses or stops in it, differently situated in each bar, and the whole of the bars are worked by two levers (one before and the other behind them) which, acting in the recesses, raise the bars to different heights, in order to give the requisite movements to the heddles. The upper ends of the bars are attached by strings to the ends of a series of jacks, and their lower ends to a series of counter-jacks, the other ends of which being connected to the heddles by strings, communicate the motions of the bars to them.

Motion is communicated to the two levers by means of a double crank affixed on the driving shaft of the loom, by the rotation of which the levers are caused to rise and fall, and by means of the bars the shed of the warp is opened and closed.

Opposite the bars is the pattern barrel, from which a number of studs project, which select the bars and force them against the levers, in order that they may be acted on by them.

The second improvement relates to the construction of jacquard cards, and consists in cementing calico, linen, or any similar woven fabric, on one or both surfaces of the cards, which are afterwards perforated; and in connecting the cards together, by cementing pieces of calico, or other

similar fabric to them, and thus forming a hinge of woven fabric, instead of linking them together by strings, as usual.

The third improvement consists in a mode of giving off warp from the warp-beams of looms.

Instead of the warp-beam being weighted as usual, and the weight constantly varied as the warp is used up, the warp is made to pass round a roller (covered with plush or woolen cloth) beneath the warp-beam. This roller is weighted to the degree desired, the weight remaining constant, and the warp-beam resting on the surface of the roller. By this arrangement the warp will draw round the roller, which being kept uniformly weighted, and being always of the same diameter, will cause the warp to be drawn off with great evenness, notwithstanding the continually decreasing diameter of the warp-beam.

The fourth improvement consists in a mode of twisting, spooling, and warping woolens, in order to obtain a more uniform warp.

The cops containing the yarns are placed on a series of spindles, and the yarns are thence conducted to the bobbins, which rest against a friction roller; and these rollers receiving motion from any suitable prime mover, communicate the same to the bobbins: a quick rotary motion being communicated to the spindles if an extra twist is to be put on to the yarns as they are wound on the bobbins.

The yards being thus wound on to the bobbins, are next placed in the warping machine; and the unwinding is performed by means of friction rollers.

The fifth improvement consists in weaving woolen doe-skins, by employing seven heddles instead of the numbers generally used. Inv. Ad.

Iron Houses.—All who have visited the exhibition of national manufactures at Brussels, must have remarked at the entrance a handsome and solid pavilion of cast iron, for which we are indebted to the Company of Conillet. This small edifice, so well constructed, appears to us an incontestible proof of the possibility of having metal architecture. But it is not generally known that architecture of this description is not so recent an invention as is generally supposed. "There is nothing new under the sun." If Hesiod, the father of poetry, is to be believed, our ancestors made use of iron for these purposes more than 3000 years ago. We are told that even their walls were constructed of this metal, and that houses were built of it. It is one proof among a thousand others, that many inventions have passed away since the commencement of the world. The pavilion is in the form of a perfect octagon, on each side of which is inserted a window with squares of colored glass. The columns placed at the angles of the pavilion support niches for statues, above which small minarets are erected. The highest part of the pavilion is surmounted with a festooned garland, which has a beautiful effect by day. Le Fanal.

New Keyed Instrument.—Mr. H. Breunig has just arrived in Liverpool from Vienna, on his way to London, with an instrument called the *Phys-harmonia Piano.* It consists of a powerful and brilliant grand pianoforte, combined with a set of reed stops of extraordinary power and sweetness, which may either be played separately or combined

with the piano. Many of our readers have, no doubt, seen and heard the Organized Pianofortes, as they were called, which consisted of a piano and a set of organ pipes, worked by the foot of the performer. The great and irremediable defect of these instruments was their liability to be out of tune, as every change in the temperature of the atmosphere has a diametrically opposite effect upon pipes and strings—heat raising the pitch of the former, and lowering that of the latter, so that the Organized Piano was seldom sufferable to an ordinary ear; and the consequence has been that they are seldom or never used at the present day. The reed stops—for such we presume them to be—of Mr. Breunig, in tone resemble that of the modern instruments, the Concertina, Seraphine, Symphonicon, &c., but it appears to us to be superior in many respects to any of those instruments which we have heard. The effect reminds us of that of a very soft and delicately played bassoon and oboe, with all the intervening shades of tone; and nothing can be conceived more pleasing or effective than the combination of the Sostenuto of the reed stop and the accompaniments of the pianoforte. Liverpool Mercury.

Musical Telegraph.—We extract from the *France Musicale* a few curious particulars relative to the invention of a kind of marine telegraph, called the "*Telephone*," invented by an ingenious Frenchman, Monsieur Sudre, and by which orders may be transmitted at night, when other means of communication fail. The Minister of Marine, taking advantage of the presence of the fleet at Toulon, invited M. Sudre on board the Trident, that he might, before the whole marine, at anchor as well as at sea, make the experiments necessary to demonstrate his method. A commission appointed by Admiral Hugon, commander of the squadron, and composed of several distinguished officers, presided by Capt. Nonay, assembled on the 6th and the 9th July, 1841, and verified by experiment the rapidity with which all naval orders could be communicated at night through the medium of a clarion, to a distance which may be increased to 2200 toises (about two miles) but which varies according to the state of the atmosphere. Subsequently, other experiments were made at ten at night, off the Hyères islands, in presence of the whole fleet, and with the same success. The Admiral wished principally to convince himself that those orders which, by the ordinary medium of signalizing, could not be transmitted at night, might be forwarded by the method of M. Sudre, to whom he gave several, thus conceived:—"The Admiral wishes to signalize the vessels which are to compose the light squadron —L'Alger, le Scipion, le Jena, la Ville de Marseilles." A few minutes after, the return of the same sounds guarantied to M. Sudre the perfect comprehension of his orders, and the Admiral congratulated him on his success. Next day the fleet sailed towards Algiers, and on its return, and at about 30 or 40 leagues from Algiers, the following orders were transmitted by the Admiral, the squadron being formed in two columns: "Each vessel to keep two cables' length distant from her consort ahead. The Admiral signalizes the point to be steered, by north-east by east. The fleet to sail in two columns, wind astern, or off the quarter, in natural order; the second squadron to the right to steer by the point signalized. In whatever order the fleet may sail, the second squadron always to take up a position to the left of the first. The Admiral orders

the fleet to steer by the point signalized, when out of danger, or when it has doubled an island or crossed a gulf."

Lastly. Towards three in the morning, the signal-trumpet from the Admiral's ship gave the following order to the fleet:—"Four in the morning, north-east." It must be observed that on these occasions M. Sudre only repeated the orders which the commander gave through the medium of his method.

Next day, at eight in the morning, the Admiral, anxious to ascertain whether his night orders had been understood and executed, ordered the Souverain, commanded by Admiral Casey, and the Trident, to signalize by flag, as customary. When this was done, Admiral Hugon, through the marine telegraph, returned the following flattering answer to M. Sudre, "Signals well executed."

On the arrival of the fleet at Toulon, the Admiral appointed a new commission, which drew up a report, in which it was *unanimously* declared that M. Sudre's telephonic system of signalizing must prove of immense utility to the navy, and it joined in eulogizing with the Admiral, as with all the preceding commissions, this extraordinary invention, to which they call the serious attention of the government. Inventors' Ad.

Newly-invented Elastic Seat.—This invention is applied to a chair as follows:—The seat or bearing surface is composcd of bars or laths, jointed at the centre, and secured at the ends to the back and front rails of the chair. The inner ends of each bar are turned down, and through these ends two spindles pass in opposite directions, being prevented from returning by a small pin inserted in each. Around each spindle is a coiled spring, which presses against the turned-down ends of the bar, and is retained on the spindle by a screw-nut and washer. By this means, if pressure is applied on the upper surface of the bars, they will be deflected, and when the pressure is removed the springs will cause the parts to return to an even surface.

When applied to bedsteads, each bar or lath has two or three spring joints, and is fastened to the side-rails of the bedstead.

The elastic surfaces so formed for chairs, sofas, &c. are covered with cushions, squabs, or mattresses, or are stuffed as before when webbing was used. lb.

Improved construction of Pianofortes.—This invention is applied to horizontal pianofortes, and consists in certain alterations and improvements in the construction and arrangement of the different parts.

The strings pass from the plate to which they are attached over the bridge on the sound board in the usual manner, and under a bridge or bearing on the underside of the wrest pin block; they are then each passed round a separate pulley, and are carried up the front of the wrest pin block to the wrest pins, to which they are attached in the usual way; the wrest pins being placed in the middle of the front of the wrest pin block. The pulleys are made in sets of two or three together, according as the pianotorte is to have two or three unisons, and the mounting of each set has a shank riveted into an iron plate screwed on the lower angle of the front of the wrest pin block, which is cut away for that purpose.

The wrest pin block is made of a rectangular form, 8 inches wide, and 4 inches deep, and is composed of two pieces, the lower one of which is cut away to admit a strap on one end of a bar (of which there are several) the other end of which is attached to the same plate that the strings are fastened to. These straps are let in to counteract the tendency of the tension of the strings to depress the front part and raise the back part of the wrest pin block; and in order further to counteract this tendency, a bolt of iron of $\frac{3}{16}$ of an inch in diameter is passed through each bar, and through the sound board and bracket, being secured at its upper end above the bar by a nut, and at the lower end beneath the bracket by a washer.

The sound board is placed at the distance of about $3\frac{1}{2}$ inches below the strings, instead of about one inch as usual, and is extended two inches more than usual towards the front of the pianoforte, under the vibrating part of the strings, and partly under the wrest pin block. The extension may be carried throughout the whole length of the scale; but it is preferred to extend it as far only as where the treble notes do not require dampers.

In order to effect the action of the key upon the hammer and damper, when the sound board is extended and depressed as described, the damper lever is placed between the sound board and the strings, and instead of the bracket being cut away to admit the damper level as usual, it is made quite straight. The key is shortened about two inches, and on the end of it is fixed a piece of metal, bent to form a right angle, to communicate the action of the key to the damper lever. The check is carried further back on the key, and instead of checking the hammer in the usual way, by the elongation of the hammer below the shank, a check piece is fastened to the middle of the shank. The hammer rest is also removed higher up, and the length of the part between the head and shank of the hammer is reduced from two inches to one inch. Ib.

Improvements in Drawing Flax and other Fibrous Substances.—At each end of the machine are two barrels or wheels with double flanges, being fixed upon horizontal shafts which revolve in suitable bearings in the standard frames, and these barrels carry two endless leather bands, provided with longitudinal rows of pins similar to heckle points. Between these endless bands are a series of transverse heckle bars, working upon the principle of the "screw gill," and traveling a certain distance along the middle of the machine.

A strick of flax, or other fibrous material to be operated upon, is placed transversely across the hind end of the machine, the portions near its ends being inserted between the pins of the endless bands, and being pressed down upon the endless bands between their pins, by narrow rollers, fixed upon a shaft which turns loosely in forks that stand up from the side-frames, thereby holding the fibres tightly distended. The fibres in the middle of the strick are then conducted forward between two conductors to two feeding rollers, by which they are led to the heckle points of the gill, and these points draw out the fibres from the pins of the endless bands, leaving the tow, &c. between those pins, whilst the clean fibres are carried forward by the heckle bars of the gill to the drawing rollers; the heckle bars moving onward at a speed

about equal to the rotary motion of the feeding rollers, which is nearly ten times faster than the endless bands. The drawing rollers revolve twenty times faster than the heckle bars travel, and thereby draw out and straighten the short fibres of the material, whilst the longer fibres being held between the pins of the gill, are by the "draft" of the drawing rollers broke into lengths, nearly equal to the distance between the bite of those rollers and the heckle points of the gill. The fibres, on passing the drawing rollers, assume the state of sliver, and are conducted through a trumpet and between the delivering rollers into a can, in which they are taken to other machinery, for the purpose of undergoing the second and third processes of drawing and refining. lb.

Zincing Iron by Electricity.—M. Sorel, a civil engineer in Paris, has announced to the Academy of Sciences that he has succeeded by means of an electro-chemical apparatus, on the principle of Daniel's constant battery, in fixing upon iron a coating of zinc of various degrees of thickness. The iron thus galvanized, without being exposed to the fire, is entirely prevented from oxidization, and the zinc adheres better to the iron than by the method of coating it in a bath of melted zinc. He has equally succeeded by an analogous process in obtaining coatings of all the other metals in different degrees of thickness, either on iron or on any other metallic or metalized substance. lb.

Improvements in the Forging of Bolts, Spikes and Nails.—The sheets of metal from which the nails, &c. are formed, are fed into a hopper, and thence descending between two rows of rotary cutters are split into rods, which rest on their ends in the bottom of a narrow trough below the cutters, being guided down into the trough by a series of plates, which stand between the cutters, and form a continuation of the hopper. In the narrow trough a rammer works, and presses the rods against the back of a tube, down which they are successively forced, in order to pass them into the dies by which they are formed into nails, &c.

The rod, on descending through the tube, is held by two side-holding dies of steel, and a steel-back die, lying as it were in a vertical trough, its front side pressing against the periphery of a circular die or disc of steel, which is capable of turning, but acts for the most part as a fixed surface. The back and side dies now descend, pressing the rod against the edge of the disc, which remains stationary, and the end of the rod is thereby drawn into a point, the back die being suitably formed for pressing it into a point on the side opposite the disc. The point of the nail, by the descending of the dies, is drawn below the disc, and by that means the front side of the nail is left unsupported; a front-holding die is therefore caused to come forward and support that side, and the dies descending a little further, force the lower end of the nail on to a heading die and form the head. The disc after the formation of each point is turned partly round, to present a fresh part of its edge to the next nail, being kept well oiled. lb.

Improvements in the manufacture of Covered Buttons.—The thin sheets of metal from which the collets for the backs of buttons are made, are first coated over on one surface with copal varnish, previously thinned

with turpentine, so as to flow freely from a painter's brush, and colored according to the color of the flock to be employed, after which the sheets of metal are submitted in an oven for about five minutes to a heat of 150° Fahrenheit. When cold, a second coat of composition or varnish is applied over the previous coating; this composition is prepared by mixing together 1 lb. of white lead, 1 pint of boiled linseed oil, and half a gill of free gold size, coloring it according to the color of the flock to be employed.

The sheets of metal thus heated are placed on what is called a drum, that is, a sheet of canvas, linen, or leather, stretched over a frame, and a quantity of flock is sifted over the prepared surface of the metal; the under surface of the drum is then struck sharply with a cane, by which means the flock is thrown up and again subsides on to the coated surface. This operation is continued until the surface of the metal is well covered with flock, and then the composition is allowed to dry for 12 hours or more. The superfluous flock is now shaken off, and the sheets of metal placed on racks for a few days, when they will be fit for use. The sheets of metal may now be formed into collets or shells for the backs of buttons, the prepared side being outwards, or may be used for any other purpose.

The flock employed is similar to that used for paper hangings, and is colored of the same color as the face of the button. lb.

A Double Telescope Theodolite.—Mr. N. Beardmore has effected an improvement in the theodolite, which consists in its having a second telescope fixed over the ordinary one, in a reverse position, so that the line of collimation of the two telescopes, when properly adjusted, should be the same. The principle advantage gained is, that a straight line may be carried out with perfect accuracy, without the tedious and uncertain process of adding 180 degrees to the observed angle, and reversing the instrument. lb.

Etching Daguerreotype Plates.—At a meeting of the Electrical Society in the Adelaide Gallery last week, a communication was received from Mr. W. B. Grove, on a voltaic process for etching daguerreotype plates, and printing from them; not, it is true, as yet with the clearness and breadth of an ordinary etching, but with all the accuracy and delicacy of the original daguerreotype, and with every promise of perfection. He says, the process possesses the advantage of extreme simplicity, and produces a perfect etching of the original image; so much so, indeed, that a plate thus etched can scarcely be distinguished from an actual daguerreotype, preserving all the microscopic delicacy of the finest parts of the impression. The secret of this process is to make the daguerreotype the anode of a voltaic combination, which will not of itself attack either silver or mercury, but of which, when electrolized, the anion will attack these metals unequally. Admitting the usual explanation of the daguerreotype, which supposes the light parts to be mercury and the dark silver, the object was to procure a solution which would attack one of these and leave the other untouched: if one could be found to attack the silver, and not the mercury, so much the better, as this would give a positive engraving, or one with the lights and

shadows as in nature; but, unfortunately, silver and mercury are nearly allied in their electrical relations. Mr. Grove made several experiments with pure silver and mercury, used as the anode of a voltaic combination, but found that any solution which would act on one acted also on the other. All then that could be expected was a difference of action. With the daguerreotype plates he has used the following:—Dilute sulphuric acid, dilute hydrochloric acid, solution of sulphate of copper, of potash, and of acetate of lead. But, after many experiments, hydrochloric acid was fixed upon as decidedly the best; this had been expected from the strong affinity of chlorine for silver. The manipulation employed by Mr. Grove and Mr. Gassiot in the laboratory of the London Institution was as follows:—A wooden frame is prepared, having two grooves at 0.2 of an inch distance, into which can be slid, the plate to be etched, and another plate of the same size of platina; this latter is platinized after Mr. Smee's method, to insure a ready and equable evolution of hydrogen; for if the hydrogen adhere to any parts of the cathode, the opposite portions of the anode are proportionably less acted on. The back and edges of the daguerreotype are varnished with a solution of shellac, which is scraped off one edge to admit of metallic connection being established. The wooden frame, with its two plates, is now fitted into a vessel of glass or porcelain filled with a solution of two measures of hydrochloric acid+1 distilled water (sp. gr. 1-1); and two stout platina wires proceeding from a single pair of the nitric acid battery, are made to touch the edges of the plates, while the assistant counts the time: this should not exceed 30 seconds. When the plate is removed from the acid, it should be well rinsed with distilled water; and will now (if the metal be homogeneous) present a beautiful sienna-colored drawing of the original design, produced by a film of the oxychloride formed. It should now be placed in an open dish, containing a very weak solution of ammonia, and the surface gently rubbed with very soft cotton, until all the deposit is dissolved. As soon as this is effected, the plate should be instantly removed, plunged into distilled water, and carefully dried.

The process is now complete, and a perfect etching of the original design will be observed. This, when printed from, gives a positive picture, or one which has its lights and shadows as in nature, and which is, in this respect, more correct than the original daguerreotype, as the sides are not inverted. Printing can therefore be directly read; and in portraits thus taken, the right and left sides of the face are in their proper position. With respect to prints from daguerreotypes, there is, however, this difficulty: if the plate be etched sufficiently deeply for a good impression, some of the finer shades of the original must inevitably run into each other, and thus the chief beauty of these exquisite images be destroyed; if, on the other hand, the process be only continued long enough to leave an exact etching of the original design, which can be done to the minutest perfection, the very cleaning of the plate by the printer destroys its beauty. At present, Mr. Grove considers the most important part of the process to be the means it offers of multiplying indefinitely daguerreotypes, which, when thus etched at the voltaic anode, will admit of any number of copies being taken from them by the electrotype process; and, to give an idea of the perfect accuracy

of these, there was one on which was a sign-board measuring on the electrotype copperplate 0.1 by 0.06 of an inch. Five lines of inscription can, with the microscope, be distinctly read. Ib.

Improvements in the manufacture of Iron.—This invention consists of a method of simplifying and accelerating the conversion of cast iron from its crude state into malleable or wrought iron.

An open refinery or furnace, such as is generally used, is constructed, and is connected with a reverberatory or puddling furnace by a passage, terminating in an aperture in the neck of the same. Through this passage the iron which has become refined in the refinery is run in a fluid state, direct from the refinery hearth into the puddling furnace, on each side of which is a door, through which the workmen perform the process of puddling in the ordinary way.

The method of charging and working the iron is as follows:—The fuel being thrown up in the refinery, and the necessary heat produced, a charge of 9 cwt. of pig or cast iron of the description generally used for forge purposes is thrown in. This is melted down and refined in the ordinary way, and when the refining process is complete, the whole charge of metal is run off in a fluid state into the puddling furnace, previously prepared to receive it, by having been heated to a proper degree of temperature, and by the workmen having protected the bottom, sides, bridges, and opening to the flue, by throwing in a sufficient quantity of limestone and iron cinders as usual. The metal being introduced into the puddling furnace, the heat is varied in the ordinary way as circumstances may require, and the iron is stirred up with bars and puddles, while the escape of the oxide of carbon in a gaseous shape takes place, and until the whole mass of iron agglutinates. It is then divided into lumps or balls of a convenient size, and the charge is drawn from the furnace, the lumps being passed to the rolling cylinders or such other contrivances as may be used for forging or compressing the iron.

In carrying out these improvements, no alteration need be made in the construction of the refinery and puddling furnace, the main feature of the invention being the causing of the heated metal of the refinery process to pass into a puddling furnace without being first permitted to cool. Ib.

New Plan of Launching Ships.—The Liffey, West India mail packet, was launched on Wednesday, from Mr. Wimshurst's patent steamship building yard, Millwall, Poplar. The Liffey is considered a very sharp vessel, and was launched on Mr. Wimshurst's plan. In lieu of cleats, &c. nailed or screwed to the bottom, a rod of iron is bent round the top of the poppets or slopings up on both sides, passed under the keel, and shackled together; a chock of hard wood is fitted between the keel and rod, with a wedge driven between the keel and chock to tighten the poppets to the vessel's bottom, then set the vessel up in the usual way with drivers. A chain being attached to the irons draws all out clear when the vessel goes into the water. Vessels of the largest size may be coppered and fitted ready for sea when launched on this improved plan, without going into dock. Ib.

Improvement in Pumps.—This invention consists in working within one long or three short barrels, two cylinders or long buckets, with valves fixed on the same in the usual way, each bucket being about 2¼ times the length of the required stroke, and being worked by slings attached to the outside of the buckets between the ends of the barrels, or through openings in the long barrel when one only is used. The ends of the buckets fit water-tight within the barrel or barrels, having cupped leathers attached to them which form the packing, and each bucket is fastened to the slings in such a way that during the stroke no opening will be made for the escape of water between the ends of the barrels and buckets. The slings, as well as the barrels and buckets, are inclosed from the bottom upwards as high as the top of the working barrel within a casing filled with water, in order to keep the cupped leather saturated, and to prevent the air from penetrating between the working barrels and buckets. A communication is formed between the water in the barrel over the top bucket and that in the barrel under the bottom bucket, by means of a small pipe leading down outside of the barrels, with a three-way cock near the top to regulate the supply of water in the casing.

The slings of each bucket are attached to a separate crank-shaft, on each of which an eccentric oval cog-wheel is fixed, driven by a third, fixed on a horizontal shaft, and placed between the other two in such a manner that the cogs on the long leverage of this driving wheel shall fit into the short-lever cogs of the adjoining wheel, and the short-lever cogs of the driving wheel into the long-lever cogs of the other adjoining wheel, so that by turning the driving wheel regularly round, one bucket or the other will be continually ascending, and causing a constant flow of water through the suction and discharging pipes. Ib.

Improvements in Tanning and Dressing Skins.—The first operation consists in preparing the skin to be tanned, by soaking it in the green or fresh state for some hours, and then submitting it to the action of apparatus afterwards described.

The fresh skins when dry are treated in the following manner:—After being well soaked for about 48 hours, they are placed in what the inventor calls a fulling machine, consisting of a framing containing a number of rammers, and having at the lower part of it a movable case, into which the skins are put, in order to be acted on by the rammers. The skins are subjected to the action of the rammers for an hour, by the repeated blows of which they are softened, and brought into a fit state to have the hair removed. They are then taken into another apparatus, consisting of a vessel of any suitable shape, in which is a horizontal axis turning in suitable bearings in the sides of the same, and having a number of rammers or beaters projecting from it; the lower part of the vessel contains the skins, and the liquor in which they are immersed. The skins are acted upon by the beaters in this apparatus for some time, and then the temperature of the vessel is raised by the admission of steam to 40° or 45° Fahr. The skins are now removed into another vessel, where they are subjected to the action of lukewarm water running through them for 24 hours.

In order to act upon the skins more quickly, limewater is used, in place of the lime milk ordinarily used for soaking the skins. After these operations have been completed, the hair may be removed from the skins with the greatest facility. The skins are then cut and pared by a machine, which removes all the pieces of flesh that adhere to them, and fits them for the other operations they have to undergo.

This machine is composed of two cylinders of copper or other suitable material, mounted upon a frame, and forming a kind of presser, (the upper cylinder being raised or lowered as required) and a rotary motion is communieated to the cylinders by suitable gearing. This machine is provided with two cutters, the lower one having a cutting blade fixed to it, and the upper one a blade without a cutting edge.

The action of the machine is as follows:—The skin is placed between the two cylinders, and pressed and drawn through according to its length. When the skin is thus arranged, the cylinders are put in motion, at the same time the upper cutter is passed over the skin, pressing it against the upper cylinder.

The skin thus pressed is drawn by the two cylinders between which it is placed, and the lower cutter is put in action, the cutting blade of which is parallel to the surface of the upper cylinder. This cutter, in acting upon the hair side of the skin, removes all the hair that may be on it, and equalizes the thickness of it.

The skins, being now ready for the tanning process, are placed in the fulling apparatus, and worked for some time in lukewarm water; after which they are placed in the second apparatus before described, and saturated for several hours in weak tanning matter. They are then removed, and piled up for about two hours; after which they are placed in stronger tanning matter, and for the three first days are removed once a day, and are afterwards left until they are sufficiently saturated; being fulled once in every 48 hours, and placed in the second apparatus for half an hour in the same tanning matter.

The improvement in currying or dressing skins is as follows:—After the skins have been tanned, they are plastered over with fatty matter, composed of oil and tallow, and are placed in a cylinder, from the inner surface of which a number of pegs or pins project, and the cylinder being made to revolve, the skins are forced against the pegs in its rotation. This action is kept up for about half an hour, when the fatty matter will be found to have penetrated into the skins, the surfaces of which will present a perfectly dry appearance; they are then stretched and dried, and further prepared by the ordinary means. Ib.

Invention for removing Mud from bottoms of Rivers.—This invention consists in applying an arrangement of apparatus to the ordinary machinery of a steamboat, in order by giving motion to what the inventor calls an "agitator," to stir up the mud, sand or other matters at the bottom of rivers and other bodies of water, and which becoming mixed with the water, will by the flowing of the same be carried away.

The agitator consists of a barrel studded with long spikes, its axis being supported at each end by a side-rod, the other ends of which are attached to a shaft extending across the interior of the vessel, and move freely on the same, in order to allow the agitator to rise and fall accord-

ing to the inequalities of the bottom of the water. This shaft is driven by gearing from the main shaft of the engine, and by means of two endless chains working round pulleys upon the axis of the agitator, causes the same to revolve, and thereby stir up the mud, &c. at the bottom of the water, the steamboat moving slowly onward, so as to cause the agitator to act over every part of the bottom that requires it. The agitator is raised up by chains and a windlass when out of use. Ib.

New Improvement for obtaining Motive Power.—This invention consists in the working of an engine by the explosive and condensive properties of certain proportions of oxygen and hydrogen gases.

The following is the mode of working the engine, which may be of any suitable construction, supposing that the piston is at the bottom of the cylinder at starting:—A quantity of oxygen and hydrogen gases, in the proportion of one part of oxygen to two parts of hydrogen, is admitted into the cylinder below the piston, the valve which admitted the gases is then closed, and the gases are exploded by any of the ordinary methods used for exploding them. By this explosion the piston is driven to the top of the cylinder, and as soon as the expansion of the gases has ceased, a vacuum is formed below the piston. This is caused by the two gases uniting and forming water, and the space below the piston which was before filled with the expanding gases is thus made a void, with the exception of a very small quantity of water. The piston is now driven down to the bottom of the cylinder, by the gases being admitted and exploded above it, producing a vacuum as above stated. Each explosion thus forces the piston into the vacuum formed by the previous explosion, and the engine will continue to work as long as the gases are admitted and exploded alternately above and below the piston.

Electrotyping.—To obtain a correct copy of a seal from a sealing wax impression, it is necessary that the seal should form one pole of a simple voltaic battery, which may be thus easily constructed. Take a piece of brown paper, free from holes, about 3 inches wide and 14 long, which wrap tightly round a cylinder of wood, about an inch in diameter, (such as a round ruler,) leaving about half an inch of the paper over the end, to turn in and form a bottom, which must be rendered water tight by the application of a little sealing wax, which should also be applied to the end of the paper along the side. Whilst the wax is still hot at the bottom, the cylinder should be placed upright in a tumbler, and the wooden mould withdrawn. Here we have two cells of the battery. We next procure a piece of zinc that will go easily into the inner or paper cell; the surface of zinc should be nearly equal to the object you wish to copy. To the top part of the metal attach a piece of copper wire, either by twisting or soldering, fixing the other end of the wire to the seal by slightly heating it in the flame of a candle. The seal must, however, be previously prepared by rubbing well over it some common black lead by means of a rather stiff camel's hair painting brush; some persons add a little spirits of wine; but if used, it must be in very minute portions, otherwise it will destroy any fine lines which may be on the seal, owing to wax being soluble in the spirit.

Having thus prepared the zinc and the seal, the metal is to be placed in the inner or paper cell, and the wire bent to form an arc to allow the seal to hang in the tumbler. The paper cell containing the zinc is then to be nearly filled with water, and the glass to the same height with a saturated solution of sulphate of copper. It is also necessary to place some crystals of sulphate of copper in a small linen bag, and suspend it by the side of the glass, that it may be in the upper part of the solution, which will thus be kept saturated.

When the above described process is completed, an electric action is produced, which is accompanied by a decomposition of the sulphate of copper; the sulphuric acid of the sulphate, passing through the paper, seizes on the zinc, forming sulphate of zinc, whilst the copper is deposited, in a metallic state, on the seal, and may be continued to any degree of thickness so long as there are any materials to keep up the electric action.

By this process a seal of sufficient thickness may be obtained in about 24 hours; but if it be desirable to hasten the process, the substitution of the nitrate of copper for the sulphate will effect that object, and a seal thick enough to seal a letter may thus be procured in seven or eight hours. Thus we may receive a letter from a friend in the morning, the seal of which may represent his crest, whilst in the evening an answer may be returned accompanied by a perfect fac-simile of his own seal. Bath Journal.

Improvement in the Manufacture of Cofered Spades, &c.—The mould of the cofered spade or other tool, instead of being made by welding two "half moulds" together, is formed out of one piece of iron, which is made of the same shape as if it was composed of two "half moulds." The mould is made red hot, and the part which is to form the straps of the spade is split by a circular saw, and opened out by a wedge-shaped tool, which is then driven into the mould in order to form the cofer. The mould is then finished in the same manner as those formed of two "half moulds," and the "steeling" of the cutting edges is performed in the usual way.

Important Invention for Navigation.—The imperfection attending the action of the log in ascertaing the rate at which ships are sailing has long been felt, and other means of attaining the same object have been anxiously desired by all captains of ships. An apparatus has been contrived and patented by M. Clement, of Rochefort, called a *Sillometer*, or watch, for indicating the speed of a ship, which has so successfully accomplished the purpose, that the French Admiralty have ordered its immediate application to the ships in the Royal Navy of France. M. Clement has taken out patents in England for this invention, and also for two others connected with it, the operations of which we will endeavor to describe as shortly as possible. The Sillometer consists of a piece of copper, called by the inventor the *agent*, against which the water acts. This agent is attached to a movable plug of the same metal, which slides in a copper tube fixed through the centre of the vessel to the keel; to this plug is attached a lever, which by means of a vertical rod acts on a second lever placed on the deck of the vessel,

and communicating with a spring; the tension of the spring constitutes an equilibrium with the presence of the water on the *agent*, and serves to measure the rate at which the ship is moving by means of a hand, the movement of which on a graduated dial indicates, at every moment, not only the speed of the ship, but also the distance run in any given time, by marking all the distances passed within short intervals. A table annexed to the instrument allows the officer of the watch to note the distance traversed at the moment when his watch is relieved. The Sillometer resolves many problems of great importance. It gives every moment the rate of the ship's sailing, and also the space traversed in any given time. It indicates positively either the influence of a sail furled or unfurled, of a change in the placing of the ballast or of the guns, and what is the most favorable direction of the wind for its action on the sails, which is very important either in giving chase or endeavoring to get away. It offers also the advantage of measuring, when at anchor, the force of currents on the keel. The second of M. Clement's inventions is called a *Derivometer*, or watch, to ascertain a ship's lee-way. It is moved by a paddle that may be placed under the keel at will, and is supported by a plug sliding in a tube like that of the Sillometer, but turning with the paddle and the rod. This motion is produced in two semi-circles, one of which indicates the lee-way to larboard, the other to starboard. When at anchor, the instrument will show clearly the direction of the currents. The third invention is a sub-marine thermometer. It appears from the thermometrical observations of many scientific navigators, that in seas of unfathomable depth, the water is not so cold as over banks; and that over banks near the shore it is less cold than over those at a greater distance, but colder than in the open sea. M. Clement, by making use of his sillometer tube places at the bottom of the plug which sustains the *agent* of the sillometer a metallic thermometer formed of a strip composed of two metals, and turned in a spiral shape, which is fixed by one end to the plug, and by the other to a vertical rod, which is so adapted as to turn two hands; one of which moves at the least alteration of temperature; the other follows the angle of rotation of the rod. In the experiments made on the coast of France, results have been obtained which show the great services this instrument may render to navigation. Cor. of Inventor's Adv.

Cure of Tic-doloureux.—A celebrated physician has communicated to us the following galvanic process for the cure of tic-doloureux. He places the extremities of a copper helix, covered with silk, in two small sponges saturated with sal ammoniac; he places one of the extremities on the part of the face that is afflicted, and the other on the corresponding part; for example, from one temple to the other, and in five minutes the nervous equilibrium is re-established. The fluid accumulated, or nervous ganglion, is conveyed from the positive to the negative pole of the helix. These experiments can be repeated with great ease. La Fanal.

Prizes offered for Inventions and Discoveries.—The Society of Industry at Mulhausen, of which we have frequently had occasion to make mention in the Inventors' Advocate, has recently issued a list of prizes for the promotion of scientific investigations, which are to be

awarded in 1842. These prizes consist of fifteen medals, or other rewards, for subjects connected with chemistry; 24 in mechanical questions; 13 on subjects relating to agriculture, two for commercial questions, and five for general subjects. The medals are to be of gold, silver, and bronze, varying in value from 1000 frs. downwards. As it is always interesting to scientific men to know the subjects which different learned and manufacturing societies consider most deserving attention, we subjoin those objects of most general importance for which prizes are offered :—

For a memoir on the causes of the spontaneous combustion of oily cotton.

For the determination of the comparative value of cochineal as a dye.

For a series of analyses of air taken from the chimneys of steam-engine boilers.

For a stiffening substance, which will serve as a substitute for Senegal gum.

For a memoir on the operation in dyeing of the substances which accompany the coloring matter of madder.

For an easy means of estimating the absolute quantity of coloring matter contained in madder.

For the production of indigo with the polygonum tinctorium.

For the manufacture of new cotton tissues.

For an instrument for measuring the velocity of air in motion.

For the best memoir on the purification of different kinds of oils, fit for oiling machinery.

For an improvement in the construction of cards for the spinning of cotton.

For a series of essays on the advantage of producing the blast of steam-boiler furnaces by a blowing machine, instead of by the draught of the chimney.

For a memoir on the different kinds of water-wheels, which may serve as a guide to the owners of works in which water is employed as the moving power.

For a steam-engine governor, superior to those already known.

For a memoir on the motion and the cooling of steam in large pipes.

For the best room stoves for burning coal or wood.

For a memoir on the transmission of motions.

For a simple and practical means of ascertaining and comparing the quality of oils intended for greasing machinery.

For detailed plans and complete descriptions of all the machines in a mill for spinning linen or worsted.

For the encouragement of boring Artesian wells.

For the introduction into the Department of a new kind of manufacture.

For the best improvement in the manufacture of bricks. Inventors' Adv.

An improved fabric for making Horse Brushes, &c.—This improved fabric is produced by weaving, in the same manner as in velvet weaving; the loom used differing from the one usually employed in velvet weaving in having the ground bar and ground or chain roller of the ordinary mat loom, instead of only the ground roller of the velvet loom,

and also in having the breast bar and knee roller of the mat loom, instead of the breast roller of the velvet loom. This alteration is necessary, that the ground may be kept tightly stretched during the operation of weaving. The harness of the loom is hung as in the ordinary mat loom.

For the ground or warp of the fabric, fine hempen or cotton yarn, dressed or undressed, or any other suitable material, is used; and for the pile, spun horse-hair is used, either alone or in combination with with spun wool or cotton; also, long horse-hair unspun, the fibre called manilla, the fibre of the cocoa-nut tree, and fine split cane or whalebone, in combination with the horse hair, spun or unspun. The ground and pole are turned on their respective rollers by the common warping mill. A shoot of fine spun hemp is used, being wound on boxwood pipes and fastened in the shuttle.

The ground roller being placed in the loom, the ground is carried over the ground bar, entered through the harness and reed, and braided down to a piece of sacking or other suitable material, which is brought up across the breast bar from the knee roller. The ground is spanded or stretched between the ground and knee rollers by a long bar and pins on those rollers, or by any other method.

The pole roller is placed in the loom, and weighted as in the ordinary velvet loom, and the pole is entered through the harness and reed, according to the usual practice in velvet weaving, (two of the ground-threads being between each pole thread) and braided down to the sack ing or other suitable material affixed to the knee roller.

The weaving is conducted in every respect the same as in ordinary velvet weaving, and the pole is cut in the ordinary manner, so as to form the pile or rough surface of the fabric. If the weaving is well done, the horse hair will be fixed sufficiently firm for all the ordinary purposes to which the improved fabric is applied; but in order to fix it in the fabric with additional firmness and security, a weak solution of gum tragacanth, in water, or the solution of caoutchouc, is used. This solution is smeared over the ground, between the ground bar and harness, and the shoot is saturated with the same.

The fabric may be made into friction gloves, horse brushes, and horse gloves, or may be used for covering seats and chairs, and for mats, rugs, &c. Ib.

Manufacture of Tinned Sheet Iron—The plates are prepared for the scaling furnace by pickling—that is, by steeping them a quarter of an hour in muriatic acid and water, which acts on the hard glossy surface, which is an oxide of iron; they are then doubled loosely, and placed singly in the bottom of a reverberatory furnace, which carries a light heat, and when they are brought up to redness they are taken out—the scale then falls off, as a pure peroxide of iron, and leaves the plate clean and free from all the hard glossy coating; they are then beaten by a boy, to disengage all the scale, and which, by beating on the round side, flattens them again. They are next passed through the cold rolls, to take out any winding in them, and make them of a closer texture on the surface. If intended for large heavy soft plates, they are then annealed, which takes all the spring out of them, and makes them much better to work. This is done by exposing them to a very low red heat,

and allowing them to cool gradually; if not annealed, they pass immediately, as do also the annealed plates, to the scouring room; there they are first put into very weak sulphuric acid and water, which removes all dirt and any very small portions of scale that might have remained attached, but does not act on the pure metallic iron—at least it should be so weak as not to do so—if it does, it will injure the plates and spoil them entirely, as the action does not cease for a long time; and though the tin may make it appear a good plate, it will be sure to work into holes when the hammer is applied. They then pass on to the tinning house, or, rather to the scouring room; after the pickling, they are passed over to the girls, where they are well washed in water, and then rubbed, both sides, with a sandy cloth, then dipped into water, to remove all the sand from the surface, then passed to the tin pots; first, they are put into a pot, with nothing but boiling palm oil, or grease, where they remain till they are up to the same heat as the oil, which is found to be the best temperature for taking the tin; it also removes all traces of acid water that might have remained on the plate. They are then put into the tin pot, where they are kept till they are quite tinned —the tin holds very fast on them sometimes, and very thick; they are then turned over to a boy, where they are again put into a pot with tin, but with a very little oil on the surface; here all the superfluous tin is melted on the plate and runs off; they are then dipped into a pot with boiling oil—next into the list pot, for removing the thick edge of tin, which always is on the lower edge of the plate; this is done by just dipping the edge of the plate into a pot, very hot, and about $\frac{3}{4}$ of an inch deep, in melted tin, and, when the list is melted, the boy strikes the flat of the plates with a piece of wood, which spirts off all the extra quantity of tin; he then just dips about one inch of the plate into strong lime water, which immediately passes all over the plate, neutralizing the oil and grease; they are now turned over to the girls, to be rubbed with sawdust and bran, to clean the surface well, and they then pass to the sorting room. Mining Journal.

Improvements in Valves for Hydraulic Engines.—These improvements consist in the addition of two or more valves to the single valve and seating commonly used for hydraulic machines, so that every valve except the uppermost may serve as a seating to that immediately over it. The valves are hung by joints one above another, the uppermost being the smallest. By this means the lift will be less than usual, in consequence of each valve admitting a quantity of water proportionate to its size. Inventor's Adv

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Improvements in the construction of Steam Boilers and Furnaces.—The mode of constructing stationary steam boilers, and their furnaces, is as follows:—The boiler for about half its length from the front end is made in the form of portions of circles, consisting of two large ones connected together by a smaller one, the form of the boiler being maintained by stay-plates, which are attached to the larger portions on each side of the smaller one, spaces being left between the stay-plates to allow a free passage for the water and steam. At the end of this half of the boiler, the smaller portion of a circle and the stay-plates terminate,

and the two larger portions of circles assume the form of two cylinders, and gradually descending a little, then proceed horizontally for a short distance. These cylinders are inclosed in a flue, which causes the heated current from the furnace to pass around and between the cylinders, against which it is also caused to impinge by bridges or checks built in the flue. The supply water is introduced by a feed-pipe into the lowest part of the cylinders, so that the boiler is filled with water at its lower extremities, whilst the upper part is occupied by water and steam in nearly equal proportions. Access is had to all the parts of the boiler through a man-hole in front of it.

The furnace is placed under the front end of the boiler, and on each side of the fire-grate are dead-plates, on which the supply of coal to the furnace is received from above, through openings called feeding mouths, which are closed by the fuel when the furnace is in full operation, but are provided with doors for closing them when that is not the case. The raking and arranging the fuel and lighting the fire is performed through a door in front of the furnace, which is opened by sliding downwards, and is for that purpose suspended from a lever, being balanced by a counterbalance weight. The fire-bars descend towards the centre of the width of the furnace, in order that the coals may be raked with greater facility from the dead-plates to the centre of the fire. The coals upon the dead-plates are roasted or coked by the heat of the furnace, and their gases liberated, and these gases in their passage to the flue pass over the fuel in the centre of the furnace, which is in a complete state of combustion, and are consumed.

The boiler for marine and inland navigation is composed of a number of portions of circles, and is divided in the interior by a number of plates, by which the mass of water is prevented from rushing to the sides or ends of the boiler, when the vessel pitches, or rolls to and fro on the water. To the lower part of the hind end of the boiler a number of small cylinders are attached, their lower ends which are in the flue being closed, and their upper ends opening into the boiler, so as to allow a free communication between the water contained in them and that in the boiler; they are placed in oblique positions, and intersect each other, so as to abstract as much of the heat contained in the flue as possible. The boiler and its furnace, which is similar to that above described, rest upon a casing filled with water, in order to prevent accidents from fire. Ib.

Improvements in Puddling and other Furnaces.—In these improvements, instead of the usual single fire-place, at the extremity of the reverberatory furnace opposite the chimney, the fire-place or grate surrounds the working hearth or bottom, on which the ores or other substances to be acted on are placed, except where it is interrupted by the working door and the canal leading to the chimney, which are opposite each other. By this means, the ores or other substances are acted upon by the flame on all sides, instead of being acted upon on one side only as usual, and therefore anthracite or other short-flamed coals may be used.

The sides and back of the furnace are hollow, and a circulation of hot or cold air is maintained in them. Ib.

DESCRIPTION OF AMERICAN PATENTS

Granted from August 11th to Sept. 4th, 1841.

Improvement in Cooking Stoves. By Sam'l L. Chase, Woodstock, Vt. Patented Sept. 1840. Reïssued Aug. 11, 1841.

Claim.—First, the manner in which I have combined and arranged the flues, including the rarefier, as set forth; that is to say, the admitting the heated air from the fire-chamber into the flue, between the upper and lower ovens; conducting it thence through the flue at one end to the flue under the lower oven; thence into the rarefying flue under the fire-chamber, and thence into the exit pipe: all substantially as herein made known and represented.

Secondly, I claim, in combination, the arrangement of the respective parts of the hearth for broiling and other cooking operations, which arrangement consists of the sunk hearth, furnished with the bars *bb*, the openings *cc* for the admission of air, the swinging hearth, and the flue formed by the notch in said hearth, and the sloping projection at the lower edge of the furnace door, or on the swinging hearth.

I also claim the swinging hearth in combination with the sunk hearth, whether the said swinging hearth be made in one or in two parts; such swinging hearth constituting, when closed, the top or cover of the sunk hearth, and being provided with boiler holes, and otherwise constructed and arranged as set forth.

Improvement in Cooking Stoves. By William A. Shepard, Waterville, Me. August 11th.

Claim.—What I claim therein, and desire to secure by letters patent, is the manner herein set forth of arranging an air-heating and cooking apparatus, by surrounding the interior of an air-heating stove by ranges of tubes, within which the air is to be heated, and thence conveyed so as to pass around an oven or other cooking instrument, and subsequently into any apartment where heated air is required; the whole being constructed, arranged and operating substantially as above described.

Improvement in Condensers of Steam-Engines, and Apparatus for supplying the Boilers with Water. By Josephus Echols, Columbus, Ga. August 11th.

Claim.—What I claim therein, and desire to secure by letters patent, is, first, the manner in which I have combined and arranged the said cistern, receptacle, the said four-way cock, and the boiler, with the said respective water passages, so as to effect the object of dispensing with force pumps, (now in use for supplying boilers) and of giving a regular supply of water to the boiler, and of maintaining it at the same and desired height at all times, as above set forth. I do not claim the use of a four way (except so far as using the plug of the same with only one passage through it) or of any of the respective parts of this apparatus taken individually, but I do claim them collectively in the particular combination described, not intending by this claim to limit myself to the exact form and manner of constructing the respective parts aforesaid,

but to vary them as I may find expedient while they remain substantially the same, as herein before set forth.

Secondly, I claim the manner in which I have combined and arranged the foregoing described apparatus for condensing steam, and for discharging a portion of the air liberated therefrom without the employment of an air-pump. That is to say, I claim the manner in which I have arranged the cold-water cistern, the steam receiver or condenser, the receptacle, and the four-way cock, so as to effect the condensation of steam, and of discharging a portion at least, and in some situations nearly all the air from said receiver or condenser, through the rain receptacle and cock, substantially as herein set forth.

Improvement in the construction of Cabooses or Stoves for Cooking. By Loftis Wood, New-York. August 11th.

Claim.—What I claim therein as new, and desire to secure by letters patent, is the manner of combining the two ovens, the fire-chamber between them, and the hollow grate bars, through each of which a current of heated air is admitted into each of the ovens, in the manner set forth.

I also claim the false or sliding oven bottoms, having racks on their lower sides, into which pinions match, by which said bottoms are to be moved in and out by a combination and arrangement of parts, as set forth.

Improvement in the construction of Windmills. By Perry Davis, Fall River, Mass. August 11th.

Claim.—What I claim as my invention, and which I desire to secure by letters patent, is the manner in which the movable tower is combined with the hollow stationary shaft B, and main shaft C, of the machine, by making the hollow shaft stationary upon the frame, as set forth, and causing the tower to revolve upon it, and combining the main shaft with the above arrangement by passing it through the hollow shaft in the manner described.

I also claim the mode of regulating the position of the wheel in relation to the wind, by means of the slide W, and cams U, X, Y, connected with the governor, bringing into or out of gear, alternately, the beveled pinions O, P, and combined with the cogged rim H, so as to alter the velocity of the wind wheel, as set forth.

Improvement in Cooking Stoves. By Sam'l L. Chase, Woodstock, Vt. August 11th.

Claim.—What I claim therein as my invention, and desire to secure by letters patent, is, first, the dividing the sunk hearth into two compartments, below the grate bars *bb*, in combination with a stove having a swinging hearth, and a draught space below the projections *aa* on said swinging hearth, in the manner and for the purpose above described.

I also claim the manner in which I have arranged and combined the flues, and the four spaces or openings leading into them from the fire-chamber; the whole being constructed, governed and operating as set forth.

Improvement in Floating Batteries. By PROSPER MARTIN, Philadelphia, Pa. August 11th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is the conversion of our common steamboats into locomotive batteries, for the protection of our harbors, cities, villages, &c. by securing the steamboats in part or in whole, in an encasement, single or double, sufficient to protect them from injury, in manner substantially as herein described.

Improvement in Air-tight Stoves. By THOMAS M. JONES, of Boston, Mass. (now residing near Birmingham, Eng.) August 11th.

CLAIM.—What I claim as my invention, is a stove without doors, having an internal vessel, with a lateral opening for the admission of fuel connected with a movable or revolving external case, that covers the whole or any required portion of the internal vessel; which external case has a lateral aperture corresponding to that of the inner vessel, and is so adjustable that as it revolves more or less, it may shut off either the whole, or more, or any part of the lateral opening of the internal vessel.

Improvement in the mode of attaching Buttons to Cloth. By HENRY S. POOLE, Boston, Mass. August 11th.

CLAIM.—I claim as my improvement, and ask a patent, for the mode of fastening the button to the cloth, by means of a metallic rivet attached to the shank of the button, and fastened on a metallic or other eyelet, as herein set forth.

Improvement in Machines for Cleaning Grain. By JONAS NOLT, West Hempfield, Pa. August 10th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is the manner in which the fall board H, the hopper K, the shoe L, and board F, for directing the currents of air upon the grain and combining together; that is to say, the arranging the hopper and shoe over the lower end of the wind board F, and inclining the fall board H on the inner side and one end, so as to allow the grain to cross the current of air; the whole being constructed and operating substantially as set forth.

Improvement in the Hydrostatic or Hydraulic Press, for pressing Cotton, &c. By JOHN HOUPT, Forkland, Ala. August 21st.

CLAIM.—What I do claim is, first, the manner of combining the follower of the press with its head or cap piece, by means of two lever beams and their connecting rods, arranged and operating in the manner and for the purpose set forth; and secondly, I claim the combining with the force pump of the hydrostatic press, an air-chamber, the air in which shall be compressed in proportion to the force with which the press is operating, and in such manner as that it shall, by its reäction, gradually diminish the quantity of water raised from the reservoir, and thus graduate the action preparatory to the operation of a smaller or more powerful force-pump, as herein fully made known.

Improvement in the manner of Dressing Millstones with Ventilators for cooling the Flour, &c. By PENDLETON CHEEK, Flat Rock, Georgia. August 21st.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is the cutting of ventiducts or ventilators in millstones, which will admit the free circulation of the air between the runner and bedstone, thereby keeping them cool, and free from heating, burning or killing the meal or flour in the act of grinding, using for that purpose my ventiducts, ventilators, or narrow deep furrows, as herein stated, and which will produce the intended effect.

Improvement in the manner of retaining in any desired position the Slats of Venetian Blinds. By JOHN HAMPSON, New Orleans. August 21st.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is the method herein described, of preventing the slats from rattling, and retaining them in any position in which they are placed, by means of the movable strip, pressed up by springs or other elastic substance, substantially as herein described.

Improvement in Steelyards for Weighing. By ELI WILLEMIN, Leesburg, Ohio. August 21st.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is the application of revolving fulcrums to steelyards and balances, by means of which the same steelyard or balance may be made to weigh any quantity, small or great.

Improvement in machines for Removing Buildings, &c. By LEWIS PULLMAN, Portland, N. Y. August 21st.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is the combination of the pivot and bolts herein referred to, with the truck employed for removing buildings and other weights, consisting of an axle and wheels, having mortises on their periphery, to which levers are adapted for moving them. Also, in combination with said truck, the screw, Fig. 3, having a movable nut, with hooks attached to it, for raising buildings, all as herein described.

Improvement in the Cut-off Valve for Steam-Engines. By HORATIO ALLEN, New-York. August 21st.

CLAIM.—What I claim in a patent for an adjustable cut-off, is as follows:—

1. I claim the combination of two independent cut-off slides, adjustable on the same rod, to be used instead of the single cut-off slide as employed in the combination patented by Isaac Adams, May, 1838, the two acting on top of the slide valve with apertures, as described on said patent; but I do not claim the slide valve with apertures; and consequently this part of my claim for an adjustable cut-off is for an improvement on Adams's cut-off, whereby the cut-off is made an *adjustable cut-off.*

2. I claim the arrangement herein denominated "cut-off with fixed seats and adjustable slides," wherein two independent cut-off slides are combined with two fixed seats, one for each end of the cylinder, and each containing an opening for the passage of the steam to its respective end; said slides being adjustable on the rod carrying them, and driven by an eccentric or cam on the engine shaft, or by the reciprocating motion of the crosshead suitably reduced, all of which is more fully described herein.

3. I claim the manner in which the two cut-off slides are made simultaneously adjustable by means of right and left hand screws on the rod carrying them, as herein more fully described.

4. I claim the arrangement and combination for turning the rod carrying the slides by means of a nut or cog-wheel, through the axle of which the rod passes, and is free to have a reciprocating motion *lengthwise*, but with which the rod must turn when the nut or wheel is turned, as more fully described herein.

5. I claim the arrangement herein denominated "cut-off with adjustable seats," wherein a cut-off slide or two cut-off slides on the same rod are combined with two adjustable seats, one for each end of the cylinder, and each containing an opening for the passage ef steam to its respective end. The cut-off slide or slides being permanently attached to the rod carrying them, and driven by a cam or eccentric on the engine shaft, or by the reciprocating motion of the crosshead of the piston, for the required movement of the slides, and the seats being simultaneously adjusted by levers from a common shaft, or by a pinion acting on a rack from each seat, or by the action of right and left screws on a rod passing through and carrying both seats, as more fully described herein.

Improvement in the construction of Moulds for Pressing Glass. By HIRAM DILLAWAY, Boston, Mass. August 21st.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is the formation of the mould for pressing glass, in such a manner that the hollow form or forms into which the articles to be manufactured are pressed, shall communicate with a larger fountain filled with melted glass, so that the forms may be filled by pressure applied to the mass of melted glass in the fountain.

Improvement in the construction of Spring Saddles. By THOMAS MARDOCK, Liberty, Ind. August 28th.

CLAIM.—What I claim therein as constituting my invention, and desire to secure by letters patent, is the particular form and manner of constructing and affixing the jewsharp spiral spring, the same being made out of a single piece of wire, and being bent and operating in the manner herein described and set forth.

Improvement in the mode of increasing Adhesion of Driving Wheels of Locomotives. By JORDAN L. MOTT, New-York. August 28th.

CLAIM.—What I claim as new, and desire to secure by letters patent, is the applying of sand to the peripheries of the driving wheels of loco-

motive engines, in combination with the application of water or steam to moisten the wheels, for the purpose of causing the sand to adhere thereto, substantially in the manner set forth, and so as to enable such locomotives to ascend inclined planes or elevations on a railroad, in consequence of the friction produced by such application. I claim also the applying of moisture and sand simultaneously to the tops of the rails in advance of the driving wheels, by means of the apparatus herein described, considering this mode of applying the moisture and sand as a mere modification of the general principle upon which the utility of my invention is dependent.

Machine for Folding and Measuring Cloth. By JOEL SPALDING, Morristown, Vt. August 16th.

CLAIM.—I shall claim spreading and folding the cloth upon the surface of the table or bed-piece in regular layers of equal lengths, as herein explained, by means of the above described arrangement of folding boards, (having a reciprocating motion) in combination with the retaining bars, operated by said folding boards, through the intervention of the lifters and levers, the whole being constructed substantially in manner as above set forth.

Improvement in the manner of constructing mortise latch Door Fasteners. By LEONARD FOSTER, Boston, Mass. August 28th.

CLAIM.—What I claim as new in my improved trinity mortise latch, and desire to secure by letters patent, is the manner in which I have arranged and combined the respective parts thereof so as to cause it to answer the triple purpose of a latch, a bolt, and a lock; that is to say, I claim the forming of the latch-bolt A with a slot, or mortise B through it, to admit of its sliding back and forth upon the square shaft of the knobs or handles DD, whilst it is capable of being raised as a latch by said handles; and this I claim in combination with the arrangements by which the thumb knob E is connected with the latch-bolt on the inner side of the door, the shank of which knob is made to operate in an opening substantially like that shown at L, in fig. 3, and is so constructed also as to be operated on by a key on the outer side of the door, in the manner described; the catch, mortises and other parts being likewise arranged and operating substantially in the manner herein made known.

I claim also the mode of applying the said latch-bolt to sliding doors, by modifying the same, as above set forth, to adapt it to this purpose.

Improvement in Cabooses for adapting them to the Distillation of Salt Water. By MICHEL ROCHER, now residing at Nantes, kingdom of France. August 28th.

CLAIM.—What I claim as constituting my invention, and which I desire to secure by letters patent, is the dividing of the caboose or cooking apparatus into two compartments, (the uppermost of which is to constitute a steam-chamber, which is separated from the lower compartment or boiler by a diaphragm or bottom NN,) the two parts being combined with each other and with the condenser, substantially in the manner and for the purpose herein set forth.

Improvement in Apparatus for supplying Steam Boilers with Water. By ETHAN CAMPBELL, New-York. August 28th.

CLAIM.—I do not intend to confine myself to the specific arrangements in the several parts, which are shown in the drawings, but to vary the same as required, according to the form of boiler, or the particular situation in which the apparatus is to be placed, still retaining the substantial character thereof.

I do not claim to have invented the valves, floats or cylinders, or any of the parts herein described as employed by me for these purposes.

But what I do claim as of my own invention, the several modes of combining the operations of the float E, and valves *w* and *x*, to admit alternately water and steam into the feeding cylinder D, and the mode of combining these parts with the float C, and valves *m* and *o*, so as to furnish a continuous supply of water to steam boilers of any form, including mechanical variations in the arrangement of the parts, which shall be substantially the same as is herein described, in the means employed and the effects produced.

Improvement in Apparatus for separating Alcohol from Whisky. By AUGUSTUS V. H. WEBB, New-York. August 28th.

CLAIM.—I do not claim as my invention, rectifying spirits or whisky by means of carbonate of potash, chloride of calcium, or any other chemical agent herein referred to having a strong affinity for waters, the same having been already employed for this purpose. But what I claim as my invention, and desire to secure by letters patent, is the manner in which I employ the substances referred to for this purpose, in connection with the cylinders and reservoirs attached to them; that is to say, I claim rectifying ardent spirits by means of one or more vertical cylinders filled with a substance having a strong affinity for water, through which the liquor is allowed to filter, combined with the reservoirs on which said cylinders rest, provided with separate faucets for letting off the water and alcohol, all as herein set forth.

Improvement in the method of combining Elevated Ovens with Cooking or other Stoves. By SAMUEL B. SPAULDING, Brandon, Vt. August 28th.

CLAIM.—What I claim therein as of my invention, and desire to secure by letters patent, is the manner herein described of combining the elevated oven with the stove by means of a connecting pipe, constructed and arranged in the manner set forth; that is to say, having an opening at its lower end adapted to the neck or collar of the stove, and widening out at its upper end so as to embrace the two openings leading into the oven flue.

I also claim, in combination with the foregoing, the flat flue C, leading from the connecting pipe B, to the exit pipe D, and embracing the outer case of the oven in its passage; said flue being furnished with a valve or damper, which, in combination with the valves or dampers F, will govern the passage of the heated air from the stove, so as to direct it through the oven flue, or through the flue C, at pleasure. The whole

apparatus being constructed, combined and arranged substantially in the manner herein made known.

Improvement in the construction of Rotary Pumps for Raising Water and other Fluids. By SAMUEL A. LEE, Boston, Mass. Sept. 4th.

CLAIM.—What I claim therein as of my invention, and desire to secure by letters patent, is the manner in which I have constructed, arranged, and combined the hollow revolving shaft, the revolving disks, and cam or piston attached thereto, and the segmental valve K, with the chamber into which it is raised by the cam I, in the manner set forth, so that these parts, with their appendages, will coöperate with each other in producing the intended effect, substantially as described.

Improvement in Lamps for Burning Lard, Tallow, and other concrete substances. By GEORGE CARR, Buffalo. Sept. 4th.

CLAIM.—I do not claim to be the first inventor of lamps for that purpose, or of using conductors of metal for rendering the concrete materials liquid by conveying heat thereto from the flame of the lamp; but what I do claim as of my invention, and desire to secure by letters patent, is the employment of hollow or tubular conductors, within which the air is to be heated, and which hollow conductors, so containing heated air, are to surround or to be surrounded by the burner containing the wick, in lamps of the Argand kind, and are to extend also in the reservoirs, for the purpose, and in the manner represented in Fig. 1 of the accompanying drawings, and described in the foregoing specification. I likewise claim the applying of the heated air vessels, as modified, represented and described herein, the same being shown in Fig. 2 of the drawing; the said apparatus, under every change of form, being so constructed as to operate upon the concrete materials by the combined influence of good metallic conductors and of heated air, and substantially in the manner herein made known.

LIST OF ENGLISH PATENTS

GRANTED BETWEEN THE 24TH OF AUGUST AND THE 22D OF SEPT. 1841.

Richard Whitaker, of Cambridge, machinist, for improvements in cutting the edges of books, and paper for other purposes; and in impressing ornaments, letters, and figures on the binding of books and on other surfaces. Sept. 4; six months.

Theophile Antoine Willhelme Count of Hompesch, of Mivart's Hotel, Brook-st. Middlesex, for improvements in obtaining oils and other products from bituminous matters, and in purifying or rectifying oils obtained from such matters. Sept. 4; six months.

John Boot, of Quandron, Leicester, lace glove manufacturer, and John King, of Henor, lace maker, for certain improvements in machinery or apparatus for manufacturing or producing figured or ornamented fabrics in warp and bobbin-net lace machines. Sept. 4; six months.

John Grafton, of Cambridge, civil engineer, for an improved method of manufacturing gas. Sept. 4; two months.

Michael Coupland, of Pond-yard, Southwark, millwright and engineer, for improvements in furnaces. Sept. 4; six months.

George Wildes, of Coleman-street, merchant, for improvements in the manufacture of white lead. (Being a communication.) Sept. 4; six months.

William Hill Darker, senior, and William Hill Darker, junior, both of Lambeth, engineers, and William Wood, of Wilton, carpet manufacturer, for certain improvements in looms for weaving. Sept. 4; six months.

Louis Lachenal, of Titchfield-street, Soho, mechanic, and Antoine Vieyres, of No. 40 Pall-mall, watchmaker, for improvements in machinery for cutting cork. Sept. 4; six months.

John Jukes, of Lewisham, gentleman, for improvements in furnaces or fire-places. Sept. 6; six months.

Pierre Pelletan, of St. Paul's Church-yard, professor of medicine, for improvements in propelling fluids and vessels. Sept. 6; six months.

Joseph Drew the younger, of St. Peter's Port, for an improved method of cutting and rolling lozenges, and also of cutting gun-wads, wafers, and all other similar substances, by means of a certain machine designed by him, and constructed by divers metals and woods. Sept. 6; six months.

Luke Hebert, of No. 12 Staple's-inn, London, for certain improvements in apparatus and metals used in the manufacture of gas for illumination; also improvements in the apparatus for burning the same. (Being a communication.) Sept. 8; six months.

Richard Else, of Gray's-inn, esquire, for certain improvements in machinery or apparatus for forcing and raising water and other fluids. Sept. 8; six months.

William Fairbairn of Millwall, Poplar, engineer, for certain improvements in the construction and arrangement of steam-engines. Sept. 8; six months.

Joseph Cooke Grant, of Stamford, ironmonger and agricultural implement maker, for improvements in horse-rakes and hoes. Sept. 8; six months.

Nathaniel Card, of Manchester, candlewick maker, for certain improvements in the manufacture of wicks for candles, lamps or other similar purposes, and in the apparatus connected therewith. Sept. 8; six months.

James Thorburn, of Manchester, machinist, for certain improvements in machinery for producing knitted fabrics. Sept. 8; six months.

Miles Berry, of Chancery-lane, civil engineer, for a new or improved method or means of, and apparatus for, cleansing typographical characters or forms of type, after being used in printing. (Being a communication.) Sept. 8; six months.

Oglethorpe Wakelin Barratt, of Birmingham, metal gilder, for certain improvements in the precipitation or deposition of metals. Sept. 8; six months.

Joseph Garnett, of Haslingden, dyer, and John Mason, of Rochdale, machine maker, for certain improvements in machinery or apparatus employed in the manufacture of yarns and cloth, and are also in possession of certain improvements applicable to the same. (Being partly a communication.) Sept. 8; six months.

Edward Loos de Schelestadt, engineer and chemist, and Etienne Sterlingne, tanner, of Regent's-square, in the county of Middlesex, for certain new or improved machinery or apparatus and process for tanning skins or hides, and preparing or operating upon vegetable and other substances. Sept. 8; six months.

George Mannering, of Dover, plumber, and Henry Harrison, of Ashford, plumber, for certain improvements in the means of raising water and other liquids. Sept. 8; six months.

Alphonse René Le Mire de Normandy, of Redcross-square, Cripplegate, doctor of medicine, for certain improvements in the manufacture of soap. Sept. 8; six months.

William Crosskill, of Beverley, ironfounder and engineer, for improvements in machinery for rolling and crushing land, and in machinery to be used in the culture of land. Sept. 9; six months.

William Hickling Bennett, of Ravensbourne Wood-mills, Deptford, gentleman, for improvements in machinery for cutting wood, and in apparatus connected therewith, part of which may be applied to other purposes. Sept. 9; six months.

Charles Louis Stanislas Baron Heurteloup, of Albany-street, Regent's-park, for an improved manufacture of continuous priming for, and improved mechanism for the application of the same to, certain descriptions of fire-arms. Sept. 9; six months.

Conrad Frederick Stoltmeyer, of Golden-terrace, Barnsbury-road, Islington, merchant, for certain improvements in obtaining and applying motive power by means of winds and waves, for propelling vessels on water, and driving other machinery. Sept. 17; six months.

William Newton, of Chancery-lane, civil engineer, for improved machinery for manufacturing felts or felted cloths. Sept. 20; six months.

Joseph Hulme, of Manchester, engineer, for certain improvements in machinery or apparatus for grinding, sharpening or setting the teeth of cards or other similar

apparatus employed for carding or operating upon cotton, wool, or other fibrous substances. Sept. 20; six months.

Thomas Huckvale, of Over Norton, Oxford, farmer, for improvements in horse hoes, and in apparatus for treating and dressing turnips, to preserve them from insects, and promote their growth. Sept. 20 ; six months.

Alfred Elam, of Huddersfield, surgical instrument maker, for improvements in apparatus or instruments for the relief and cure of procedencia and prolapsus uteri. Sept. 20; six months.

Luke Hebert, of Birmingham, for improvements in machinery for fulling woolen cloth. (Being a communication.) Sept. 20; six months.

William Charlton Forster, of Bartholomew Close, gentleman, for a material, or compound of material, not hitherto so used for preventing damp rising in walls, and for freeing walls from damp, which material or compound of material can be applied to other purposes. Sept. 20; six months.

François Marie Agathe Dez Maurel, of Newington Terrace, Surrey, for an improved buckle. Sept. 20; six months. (Being a communication.)

George Shillibeer, of Milton-street, Euston-square, carriage builder, for improvements in the construction of hearses, mourning and other carriages. Sept. 20; six months.

William Bush, of Deptford, engineer, for improvements in the means of, and in the apparatus for, building and working under water. Sept. 21; six months.

Comte Melano de Calcina, of Nassau-street, Soho, for improvements in paving or covering roads, and other ways, or surfaces. Sept. 21; six months.

Edward Emanuel Perkins, of Weston Hill, Norwood, gentleman, for improvements in the manufacture of soap. Sept. 21; six months.

John Duncan, of Great George-street, Westminster, gentleman, for improvements in machinery for driving piles. Sept. 21; six months.

Henry Bessemer, of Baxted House, St. Pancras, engineer, and Charles Louis Schonberg, of Sidmouth Place, Gray's Inn Lane Road, artist, for improvements in the manufacture of certain glass. Sept. 23; six months.

George Scott, of Louth, miller, for certain improvements in flour mills. Sept. 23; six months.

James Whitelaw, engineer, of Glasgow, and James Stirratt, manufacturer, of Paisley, Renfrew, for improvements in rotary machines to be worked by water. Sept. 23; six months.

LIST OF IRISH PATENTS GRANTED FROM JULY 10TH TO SEPT. 7, 1841.

J. Ransome and C. May, for improvements in the manufacture of railway chairs, railway and other pins, or bolts, and in wood fastenings and tree-nails.

William Petrie, for a mode of obtaining a moving power by means of voltaic electricity, applicable to engines and other cases where a moving power is required.

John Barnett Humphrey, for certain improvements in shipping generally, and in steam vessels in particular; some of these improvements being, individually, novel, and some the result of novel application or combination of parts already known.

John Haughton, for improvements in the means employed for preventing railway accidents, resulting from one train overtaking another.

Moses Poole, for improvements in tanning and dressing, or currying of skins. (Being a foreign communication.)

Edward Foard, for an improved method or improved methods of supplying fuel to the fire-places or grates of steam-engine boilers, brewers' coppers, and other furnaces; as well also to the fire-places employed in domestic purposes, and generally to the supplying of fuel to furnaces or fire-places, in such a manner as to consume the smoke generally produced in such furnaces or fire-places.

William Newton, for certain improvements in machinery for making pins and pin nails. (Being a communication from abroad.)

Moses Poole, of Lincoln's Inn, Middlesex, gentleman, for certain improvements in the manufacture of fabrics, by felting. (Being a communication from abroad.)

William Palmer, for improvements in the manufacture of candles, and in apparatus for applying light.

John Rangely, for improvements in the construction of railways, and in the means of applying power to propelling carriages and machinery.

John Lee, of Newcastle-upon-Tyne, manufacturing chemist, for improvements in the manufacture of chlorine.